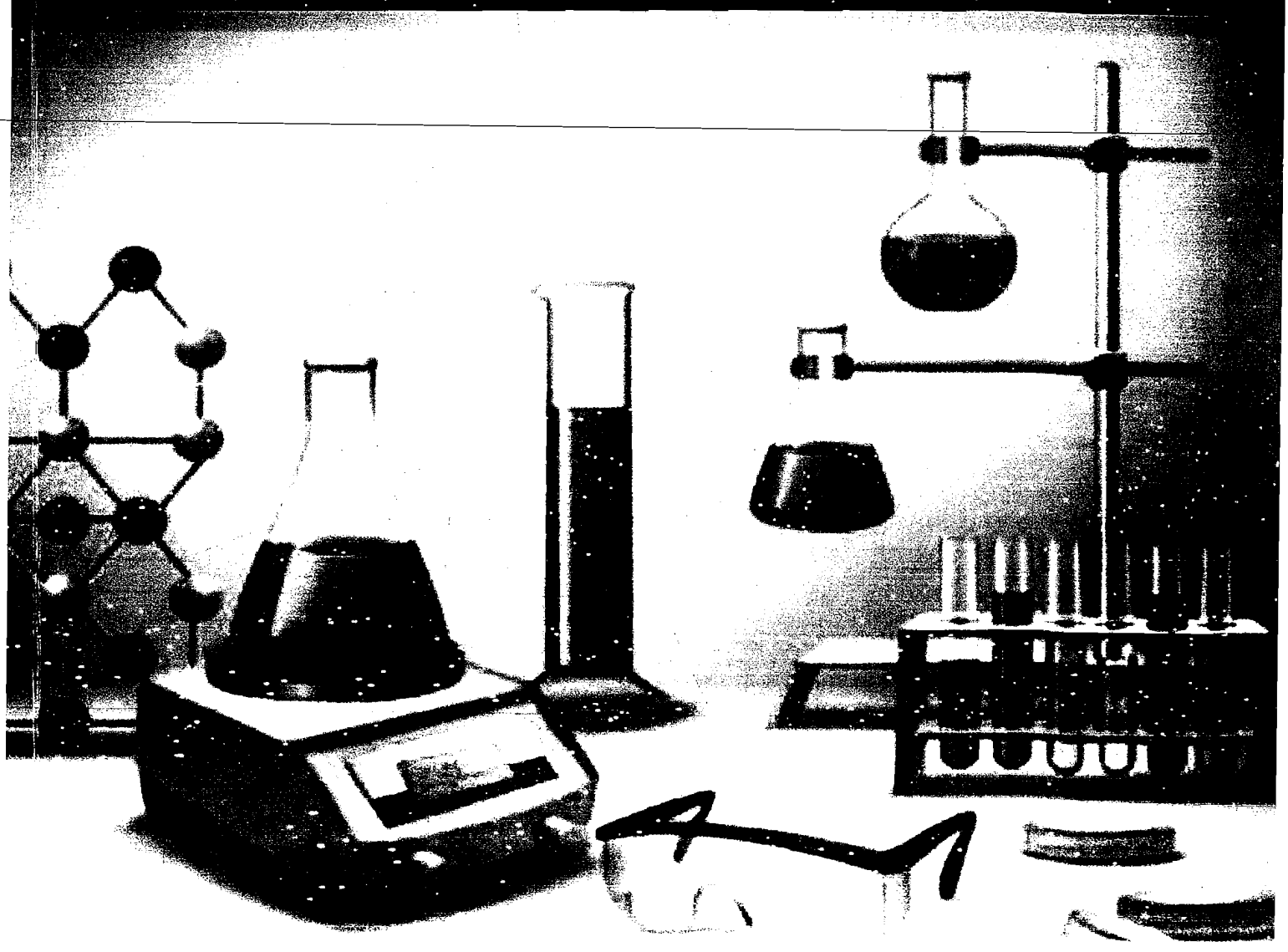
9 Model Papers + One Model Paper given by Karnataka School Examination & Assessment Board with scheme of answers

II PUC

Question Bank Capsule Containing 15 MCQ + 5 Fill in the Blanks as per KSEAB Guidelines

From State Chemistry Forum

Karnataka State Chemistry Lecturers Forum (R), Bengaluru



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Revised Edition - 2023

Published by : **KSPUCLF, Bangalore**
For copies contact forum members
Price : Rs. 60/-

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Tejas.NB

ಮನವಿ

ಪ್ರೀತಿಯ ಅಧ್ಯಾಪಕ ಮಿತ್ರರೇ ಹಾಗೂ ವಿದ್ಯಾರ್ಥಿಗಳೇ,

2022–23ನೇ ಸಾಲಿನಿಂದ ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪದವಿಪೂರ್ವ ಶಿಕ್ಷಣ ಇಲಾಖೆಯು **CBSE** ಪಠ್ಯಕ್ರಮವನ್ನು ಅನುಸರಿಸಿ – **NCERT** ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಉಪಯೋಗಿಸಲು ನಿರ್ಧರಿಸಿದೆ, ಇದರ ಅನ್ವಯ ನಾವು ಪಠ್ಯ ವಿಷಯ ಹಾಗೂ ಬೋಧನಾ ಮಟ್ಟದಲ್ಲಿ ಸಾಕಷ್ಟು ಬದಲಾವಣೆಗಳನ್ನು ಕಾಣುತ್ತಿದ್ದೇವೆ. ಈ ಬದಲಾವಣೆಗಳಿಗೆ ತೊಡಗಿಸಿಕೊಳ್ಳಬೇಕಾದ ಅವಶ್ಯಕತೆ ಹಾಗೂ ಅನಿವಾರ್ಯತೆ ನಮ್ಮೆಲ್ಲರ ಮೇಲಿದೆ. ಇದಕ್ಕೆ ಪೂರಕವಾಗಿ ರಾಜ್ಯದ ರಸಾಯನಶಾಸ್ತ್ರ ಉಪನ್ಯಾಸಕರ ವೇದಿಕೆಯು ಈ ಕೈಪಿಡಿಯನ್ನು 2022–23ನೆ ಸಾಲಿನಲ್ಲಿ ತಮ್ಮ ಕೈಗೆ ತಲುಪುವಂತೆ ಮಾಡಿತ್ತು. ಇದರಿಂದ ಉತ್ತಮ ಬೇಡಿಕೆ ಮತ್ತು ಮೆಚ್ಚಿಗೆ ವ್ಯಕ್ತ ಪಡಿಸಿದ್ದಕ್ಕೆ ತಮ್ಮೆಲ್ಲರಿಗೂ ವೇದಿಕೆ ಧನ್ಯವಾದಗಳನ್ನು ಅರ್ಪಿಸುತ್ತದೆ.

ಈ ಕೈಪಿಡಿಯ 7ನೇ ಆವೃತ್ತಿಯನ್ನು ಹೊರತರಲು ಪ್ರತ್ಯಕ್ಷವಾಗಿ ಹಾಗೂ ಪರೋಕ್ಷವಾಗಿ ದುಡಿದ ಎಲ್ಲ ಮಿತ್ರರಿಗೆ ನಮ್ಮ ವಂದನೆಗಳು ಸಲ್ಲುತ್ತವೆ.

ಈ ಕೈಪಿಡಿಯನ್ನು ಸಾದರವಾಗಿ ಸ್ವೀಕರಿಸಿ, ಇದನ್ನು ಉತ್ತಮಪಡಿಸುವ ಉದ್ದೇಶದಿಂದ, ತಮ್ಮೆಲ್ಲರ ಅತ್ಯಮೂಲ್ಯ ಸೂಚನೆ ಹಾಗೂ ಸಲಹೆಗಳನ್ನು ವೇದಿಕೆ ಸ್ವೀಕರಿಸಿ ಪರೀಕ್ಷೆಯ ದೃಷ್ಟಿಯಿಂದ ಕೆಲವು ಮಾರ್ಪಾಡುಗಳನ್ನು ಮಾಡಿರುತ್ತದೆ ಹಾಗೂ ಇನ್ನು ಉತ್ತಮ ಪಡಿಸಲು ತಮ್ಮೆಲ್ಲರ ಸಲಹೆ ಮತ್ತು ಸೂಚನೆಗಳನ್ನು ವೇದಿಕೆ ಸದಾ ಸ್ವಾಗತಿಸುತ್ತದೆ.

ಎಲ್ಲಾ ರಸಾಯನಶಾಸ್ತ್ರ ಉಪನ್ಯಾಸಕ ಮಿತ್ರರು ಈ ಕೈಪಿಡಿಯನ್ನು ತಮ್ಮ ಕಾಲೇಜುಗಳಲ್ಲಿ ಬಳಸುವ ಮೂಲಕ ರಾಜ್ಯದಾದ್ಯಂತ ಏಕರೂಪತೆಯನ್ನು ಸಾಧಿಸುವ ವೇದಿಕೆಯ ಆಶಯವನ್ನು ಬೆಂಬಲಿಸಬೇಕೆಂದು ಕೋರುತ್ತೇವೆ.

ವಂದನೆಗಳು,

ಕಾರ್ಯಕಾರಿ ಸಮಿತಿ

ಕ.ರಾ.ಪ.ಪೂ. ರ.ಶಾ.ಅ. ವೇದಿಕೆ

PREFACE :

The State Chemistry forum developed Question paper capsules in chemistry for the second year P.U. students with the objective to provide the students a large number of Quality Questions and problems in various forms and format namely multiple choice Questions, Short answer Questions and long answer Questions with varying levels of difficulties.

This is very important for II P.U. Board examination. The Questions given in the book are mainly of expected and higher difficulty order by practising these Questions and Problems. Students will able to manage with the margin between a good score and an excellent score. We have made this book unique for the benefit of the students in such a way that it presents not only hints and solutions but also detailed and authentic explanations. Students can learn the concepts through these detailed explanations which will enhance their thinking and learning abilities.

We would like to Thank Mr.Manjunath Bhat, Rajeev Naregal, Jayaramu.K, Channegowda.T.M, Gireesha.C, Siddanagouda, Sudharshan, Dr. Srinivasa, Secretary Rameshchandra Reddy.P.B and all executive committee members for the completion of this book, they wrote, checked and revised all Questions and answers.

With the hope that this book will be of great help to the Students. We wish great success to our learners.

S.G.Rajashekar
President
Karnataka State PU Chemistry Lecturers Forum (R),
Bengaluru

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BLUE PRINT FOR II PUC CHEMISTRY CAPSULE 2023-24

SUBJECT: CHEMISTRY **BLUE PRINT** **CLASS: II PUC**

Chapter/ Content domain/ Unit/ Theme	Number of hours	Marks	Remember (≈ 40%)				Understand (≈ 30%)				Apply (≈ 15 TO 20%)				HOTS (≈ 10 TO 15%)			
			VSA (01 Mark)	SA (02) Marks	SA (03 Marks)	LA	VSA (01 Mark)	SA (02 Marks)	SA (03 Marks)	LA	VSA (01 Mark)	SA (02 Marks)	SA (03 Marks)	LA	VSA (01 Mark)	SA (02 Marks)	SA (03 Marks)	LA
Physical Chemistry																		
Solutions	14	13	1	-	1 (T)	-	-	-	-	-	1	1	1 (NP)	-	-	-	1 (NP)	-
Electrochemistry	14	14	1	-	1 (T)	-	-	-	1 (T)	-	-	-	-	-	1	-	2 (NP)	-
Chemical Kinetics	14	13	1	-	1 (T)	-	1	1	-	-	-	-	1 (NP)	-	-	-	1 (NP)	-
Inorganic Chemistry																		
The d & f- Block Elements	12	11	1	-	1	-	-	-	1	-	-	-	1	-	1	-	-	-
Coordination Compounds	12	12	-	-	2	-	1	1	1	-	-	-	-	-	-	-	-	-
Organic Chemistry																		
Haloalkanes and Haloarenes	10	09	1	-	-	-	1	-	-	1	-	1	-	-	-	-	-	-
Alcohols, Phenols and Ethers	12	12	1	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-
Aldehydes, Ketone and Carboxylic Acids	14	14	1	1	-	1	1	-	-	-	-	-	-	1	-	-	-	-
Amines	08	08	1	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-
Biomolecules	10	09	1	1	-	1	1	-	-	-	-	-	-		-	-	-	-
Total Teaching Hours & Marks	**120**	**115**	**09**	**04**	**18**	**15**	**07**	**04**	**09**	**15**	**01**	**04**	**09**	**05**	**03**	**00**	**12**	**00**
			46				35				19				15			
Total Questions		**49**	**09**	**02**	**06**	**03**	**07**	**02**	**03**	**03**	**01**	**02**	**03**	**01**	**03**	**00**	**04**	**00**

1. Weightage = Total marks/Number of teaching hours = 115/120 = 0.96 (i.e., 0.96marks for each hour)
2. Choice = out of 49 Questions only 35 Questions are to be answered.

Note: T = Theory; NP = Numerical Problems; VSA = Very Short Answer (MCQ's and Fill in the Blanks); SA= Short Answer; LA = Long Answer

Model Question Paper-1
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part- A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. Which of the following unit is useful in relating concentration of solution with its vapour pressure?
   a) Mole fraction b) parts per million c) mass percentage d) molality
2. The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called
   a) Cell potential b) cell emf c) potential difference d) cell voltage
3. Electrolysis of aqueous sodium chloride (NaCl) will produce;
   a) sodium at cathode and H_2 gas at anode b) Cl_2 at anode and H_2 gas at cathode
   c) both sodium and Cl_2 produced at the cathode d) Na at cathode and Cl_2 gas at anode
4. The molecularity of reaction cannot be
   a) Zero b) One c) both (a) and (b) d) whole number
5. Which of the following transition metal ions is colourless
   a) V^{+2} b) Cr^{+3} c) Zn^{+2} d) Ti^{+3}
6. Which of the following is an ambidentate ligand?
   a) CO b) NH_3 c) SCN^- d) Cl^-
7. Which one of the following has the lowest boiling point?
   a) CH_3Cl b) C_2H_5Cl c) C_2H_5Br d) C_2H_5I
8. When a secondary alcohol is treated with copper at 573K, It forms.
   a) An aldehyde b) a ketone c) alkene d) carboxylic acid
9. When Phenol is treated with dilute HNO_3 at low temperature and the products are separated by;
   a) simple distillation b) sublimation
   c) steam distillation d) reduced pressure distillation

10. Hybridization of carbon of carbonyl group is;
    a) sp b) sp^3d c) sp^3 d) sp^2
11. Which of the following are strongest and weakest acids respectively?
    A) $F\text{-}CH_2COOH$ B) CH_3COOH C) $Cl\text{-}CH_2\text{-}COOH$ D) $Br\text{-}CH_2COOH$
    a) B&C b) A & B c) D & B d) A & C
12. The IUPAC name of amine $(H_3C)_2N\text{-}CH_2\text{-}CH_3$
    a) N,N-Dimethylethanamine b) 1,1-Dimethylethanamine
    c) N-Dimethylethanamine d) N-Ethyl-N-methylmethanamine
13. Which of the following does not react with $C_6H_5SO_2Cl$?
    a) Primary amine b) Secondary amine c) Tertiary amine d) Both (a) and (b)
14. The number of peptide bonds present in a tetrapeptide is;
    a) One b) Two c) Three d) Four
15. Ascorbic acid is a chemical name of;
    a) Vitamin A b) Vitamin D c) Vitamin K d) Vitamin C

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

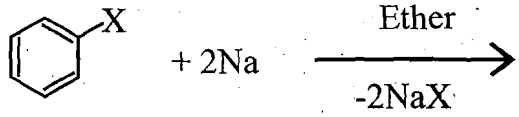
(2-Butene, one, dissociation, hydrogen bonds, Zero, 1-Butene)

16. Van't Hoff factor for a solute is more than 1 indicates that the solute undergoes _____ in solution.
17. Units of rate constant and rate of reaction for a _____ order reaction are same.
18. The number of unpaired electrons present in Cu is _____
19. _____ is the major product forms when elimination of HBr from 2-bromobutane.
20. Lower aliphatic amines are soluble in water due to the formation of _____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. What are isotonic solutions? What happens when such solutions are separated by semi permeable membranes?
22. Show that the half-life period of a first order reaction is independent of initial concentration of reacting species.
23. What are heteroleptic complexes? Give an example.
24. Complete the following equation and name the reaction



25. Explain HVZ (Hell-Volhard-Zelinsky) reaction with equation.
26. Name the fat storing gland and tissue in animal body where fat soluble vitamins are stored.

Part-C

IV. Answer any three of the following. Each question carries three marks: **3x3=9**

27. a) Calculate the magnetic moment of Ti^{3+} ion [atomic number of Ti-22]
    b) Give reason: 3d-series elements exhibit variable oxidation states.
28. Explain the manufacture of potassium dichromate from chromite ore
29. What are interstitial compounds? Write their characteristics.
30. Give the IUPAC name of $[CoCl_2(NH_3)_4]Cl$ and draw cis and trans isomers of $[CoCl_2(NH_3)_4]^+$
31. Using valence bond theory account for the geometry and magnetic nature of $[Co(NH_3)_6]^+$ ion. (Atomic number of Co=27).
32. State any three postulates of Werner theory of Coordination Compounds.

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Give the main points of distinction between non-ideal solutions showing positive and negative deviations.
34. Draw labeled diagram of standard hydrogen electrode (SHE). Write its half cell reaction and E° value.
35. What are fuel cells? Write the cathodic and anodic cell reactions of Hydrogen-Oxygen fuel cell
36. Derive the integrated rate equation for rate constant of first order reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a) Explain the mechanism of S_N1 reaction for the conversion of t-butyl bromide to t-butyl alcohol.
    b) Aryl halides are extremely less reactive towards nucleophilic substitution reactions. Give any two reasons. **(3+2)**
38. a)Explain the preparation of phenol from cumene.
    b)What happens when a Carboxylic acid is treated with alcohol. Write the general equation.
39. a) $H\text{-}CHO \xrightarrow[2.\ H_2O]{1.\ RMgX,\ ether} X \xrightarrow[300^0C]{Cu} Y$. Identify X and Y?
    b) What is the effect of **(2+3)**
    (i) electron withdrawing group on acidity of phenols.
    (ii) electron donating group on acidity of alcohols.
    (iii) increasing number of carbon atoms on boiling point of alcohols.
40. a)Write the product formed in the following.

    i)  $+ CH_3COCl \xrightarrow[AlCl_3]{Anhydrous}$

    ii) $\begin{matrix} H_3C \\ H_3C \end{matrix}\!\!>\!\!=O + NH_2OH \longrightarrow$

iii) $CH_3\text{-}Mg\text{-}Br + CO_2 \xrightarrow[H_3O^+]{\text{dry ether}}$

b) Write equation for the reaction between benzaldehyde and concentrated NaOH solution. Name the reaction.

41. a) pK_a values of three carboxylic acids A, B and C are 12.3, 14.6, 9.8 respectively. Arrange them in the increasing order of their acid strength.

b) Explain decaboxylation reaction and write general equation.

c) What is Jones reagent?

42. a) Give equation to prepare methanamine by Gabriel Phthalimide synthesis.

b) Name the major organic product formed in the following conversion.

(i) When nitrous acid is treated with methylamine.

(ii) Benzene diazonium chloride is treated with KI

c) Tertiary amines cannot be acylated. Why?

43. a) What is denaturation of proteins? Which level of structure remains intact during denaturation?

b) How do you show that i) Glucose contains six carbon atoms in straight chain.

ii) Glucose contains carbonyl group?

c) Give an example for polypeptide type of harmone.

PART-E

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. An aqueous solution of organic compound containing 0.6g of it dissolved in 21.7 g of water, freezes at 272.187K. If the value of K_f is 1.86K kg mol for water which freezes at 273K, Calculate the molecular mass of organic compound.

45. The vapour pressure of water is 12.3kPa at 300K. Calculate the vapour pressure of one molal solution containing a solute dissolved in it.

46. How long has a current of 3 ampere to be passed through a solution of silver nitrate to coat a metal surface of 0.42 g (Atomic mass of Ag-108).

47. The resistance of M/10 solution is found to be 2.5 X 10^3 ohms. Calculate the molar conductance (Given: Cell constant 1.15 cm^{-1})

48. A first order reaction requires 30 minutes for 50% completion. Calculate

i) rate constant and

ii) using rate constant calculate the time required for 75% completion of reaction.

49. The specific reaction rate of a reaction triples when the temperature changes from 30°C to 50°C. Calculate the energy of activation of the reaction. (Given: R=8.314 $JK^{-1}mol^{-1}$)

Answers

I.

1	2	3	4	5	6	7	8	9	10
a	b	b	a	c	c	a	b	c	d
11	**12**	**13**	**14**	**15**					
b	a	c	c	d					

II.

16. Dissociation
17. Zero
18. One
19. 2-Butene
20. Hydrogen bond

Part - B

III.

21. Two solutions having the same osmotic pressure are called isotonic solutions. When they are separated by semipermeable membranes, the process of osmosis does not takes place.
22. For the first order reaction,

When $K = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$

Hence $t = t_{1/2}, [R] = \frac{[R]_0}{2}$

$$K = \frac{2.303}{t_{1/2}}\log\frac{[R]_0}{\frac{[R]_0}{2}}$$

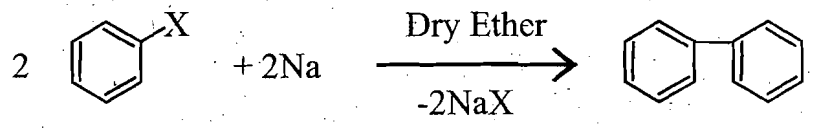
$$t_{1/2} = \frac{2.303}{k}\log 2$$

$$t_{1/2} = \frac{2.303 \times 0.301}{k}$$

$$t_{1/2} = \frac{0.693}{k}$$

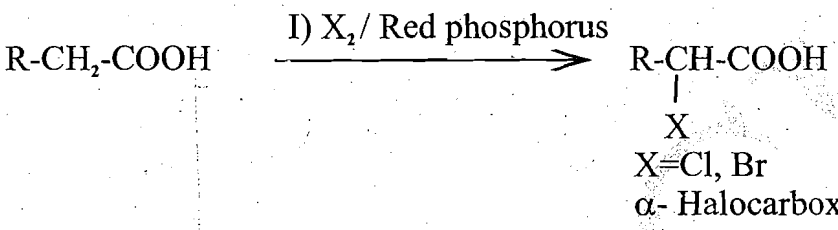
$\therefore$ The half-life period of a first order reaction is independent of initial concentration of reacting species.

23. Complexes in which a metal ion or atom is bound to more than one kind of donor groups (ligands) are called heteroleptic complexes.
Ex $[CoCl_2(NH_3)_4]^+$

24. 

Fittig reaction

25. Carboxylic acids containing a hydrogen reacts with chlorine or bromine in the presence of small quantities of red phosphorus to form α-halo acids. This reaction is known as Hell-Volhard-Zelinsky reaction.



26. Liver and adipose tissue

Part - C

IV.

27. a) $Ti^{3+} \rightarrow [Ti = [Ar]4s^2 3d^2] \longrightarrow$ 

$\mu = \sqrt{n(n+2)}$

$= \sqrt{1(1+2)} = \sqrt{3} = 1.73BM$

Ti^{3+}=1 unpaired electron

b) This is because there is a little energy difference between (n-1) d and ns orbitals hence in transition elements electron from both (n-1)d and ns orbitals are used up for bonding.

28. **Step 1: [conversion to sodium chromate]:** The concentrated ore is mixed with sodium or potassium carbonate in excess of air,

$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

Step 2:Conversion to sodium di-chromate: The yellow solution of sodium chromate is filtered & acidified with H_2SO_4 to give orange coloured sodium di-chromate.

$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

Or

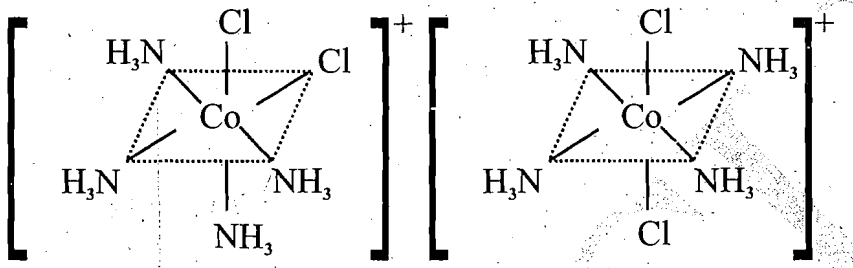
$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

Step 3:conversion to potassium dichromate: Sodium di- chromate is more soluble than potassium di- chromate hence sodium di-chromate is treated with calculated amount of KCl to give potassium di-chromate.

$$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$$

29. Interstitial compounds are those which are formed when small atoms like hydrogen Carbon or nitrogen are trapped inside crystal lattices of certain metals.
Ex: TiC, Mn_4N, Fe_3H, $VH_{0.56}$ and $TiH_{1.7}$, etc.
Characterstics: High M.P, higher than those of pure metals, very hard, retain metallic conductivity and chemically inert.

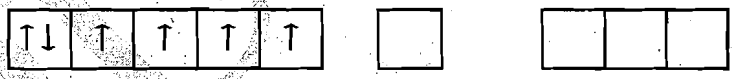
30. IUPAC name: tetraamminedichloridocobalt(III)chloride



Cis trans

31. The central metal is Cobalt its electronic configuration is [Ar] $3d^7 4s^2$
Its oxidation state is +3 hence Co^{3+} electronic configuration is [Ar] $3d^6$

Co^{3+}[Ar]$3d^6$ Ground state:

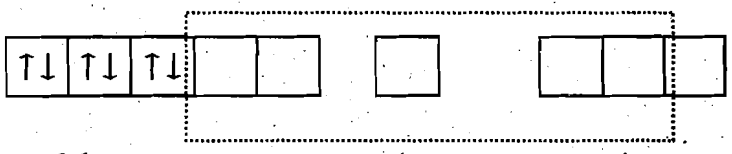


3d 4s 4p

NH_3 is a strong ligand, hence pairing of electrons takes place in d-orbitals.

two vacant 3d orbitals, one 4s orbital and three 4p orbitals hybridise to give 6 equivalent d^2sp^3 hybridorbitals, oriented octahedral in space

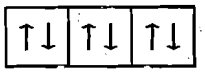
Excited state:

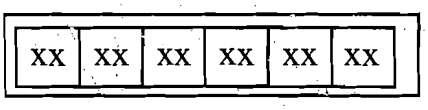


3d 4s 4p

d^2sp^3 hybridisation

each NH_3 ligand donates a pair of electron to form a octahedral complex





d^2sp^3 hybridisation

Hybridization : d^2sp^3 hybridization
Magnetic property : diamagnetic
Geometry : octahedral

32 In co-ordination compound metal exhibit 2 type of valencies.

1) Primary valency

2) Secondary valency

Primary valencies are ionisable and represents the oxidation state of a metal.

Secondary valencies are non-ionisable & represents the co-ordination number.

Primary valencies satisfied by anion (-ve ions).

Secondary valency satisfied by both neutral & anions or molecules are called legands.

Primary valency is not fixed.

Secondary valency is fixed due to co-ordination number which is fixed.

Primary valency is non-directional

Secondary valency is directional space it gives a definite geometry to complex ion.

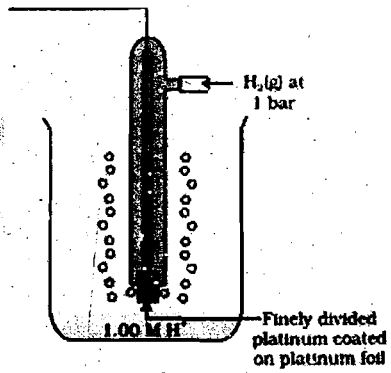
If the co-ordination number is 4 (its geometry) is tetrahedral of square pyramidal.

V

33.

Positive deviation from Raoult's law		Negative deviation from Raoult's law	
1)	Heat is absorbed during dissolution $\Delta H>0$	1)	Heat is evolved during dissolution $\Delta H<0$
2)	Volume increases during dissolution $\Delta V>0$	2)	Volume decreases during dissolution $\Delta V<0$
3)	Attractive force between A-B is weaker than A-A and B-B attractive forces	3)	Attractive force between A-B is stronger than A-A and B-B attractive forces
4)	Forms minimum boiling point azeotrope	4)	Forms maximum boiling point azeotrope
5)	$P_{total} > P_A^0 X_A + P_B^0 X_B$	5)	$P_{total} < P_A^0 X_A + P_B^0 X_B$

34)



- It consists of a platinum electrode coated with platinum black. The electrode is dipped in 1.00M HCl solution and pure H_2 gas at 1 bar pressure is passed to it.
- It is represented symbolically as $Pt(s)|H_2(gas)\ 1bar||\ H^+(aq)\ 1.00M)$
- The half cell reaction is given as $H^+(aq) + e^- \rightarrow \frac{1}{2} H_2(g)$
- The standard electrode potential of SHE at all temperature is assigned Zero potential ($E^0 = 0.0$ V)

35. Galvanic cells which convert the energy produced during the combustion of fuels like hydrogen, methane, methanol etc directly into electrical energy are called fuel cells

Anode: $2H_2(g) + 4OH^-(aq) \rightarrow 4H_2O(1) + 4e^-$

Cathode: $O_2(g) + 2H_20(1) + 4e^- \rightarrow 4OH^-$

36. First Order Reaction has the rate of the reaction is proportional to 1st power of the concentration of reactants. Consider the reaction, $R \rightarrow P$

$Rate = -d[R]/dt = k[R]^1 = k \times [R]$

$d[R]/[R] = -kdt$ (integrating both sides)

$\ln [R] = -kt + I$ (where, I = integration constant)

$\ln [R]_0 = -k \times 0 + I$ (at $t=0$, $[R]=[R]_0$=initial concentration of the reactant)

$\ln [R]_0 = I$

From equation (1), $\ln [R] = -kt + \ln [R]_0$ (because $I = [R]_0$)

Therefore,

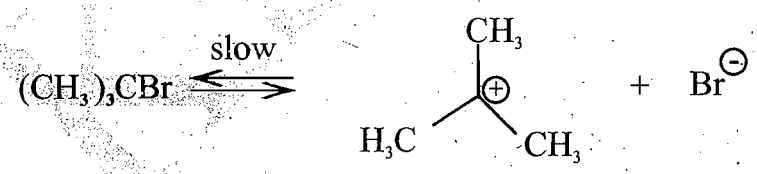
rate constant $k = \frac{1}{t} \ln \frac{[R]_0}{[R]} = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$

Part - C

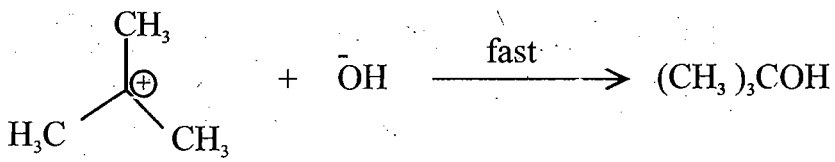
VI.

37. a)

I Step: Tertiary butyl bromide ionizes slowly to give sp^2 hybridised planar tertiary butyl carbocation and bromide ion.

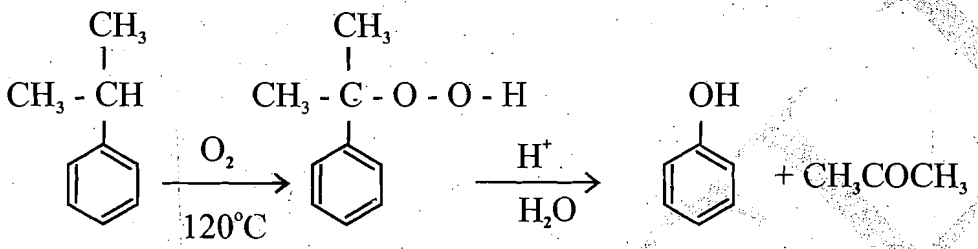


II Step: The nucleophile $\bar{O}H$ from aqueous NaOH attacks planar carbocation on either side to give tertiarybutyl alcohol.



b) • C-X bond acquires double bond character due to resonance
- Difference in hybridization of carbon atom in C-X bond in haloarenes the C-atom attached to halogen is sp^2 hybridised i.e greater 's' character is more electronegative and can hold the electron pair of C-X more tightly
- Instability of phenyl cation.
- Because of possible repulsion due to electron rich arenes.

38. a) Cumene or isopropyl benzene is oxidized in the presence of air to give cumene hydroperoxide. It is converted to phenol and acetone by treating it with dilute acid.



Cumene — Cumene hydroperoxide — Phenol — Acetone

b) Esterification.

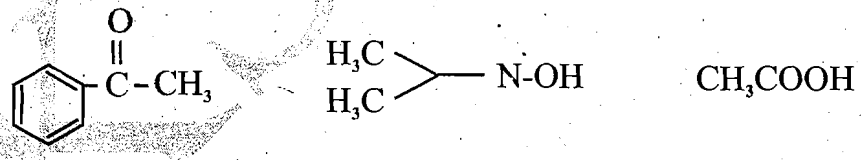
$$RCOOH + R^1\text{-}OH \xrightarrow{Conc.H_2SO_4} RCOOR^1 + H_2O$$

39. a)

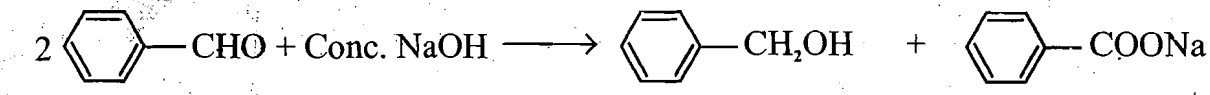
$$X \longrightarrow R\text{-}CH_2OH, \quad Y = R\text{-}CHO$$

b) (i) Acidity increases
(ii) Acidity decreases
(iii) Boiling point increases with increasing number of carbon atoms.

40. a) (i) (ii) (iii)



b)



Benzaldehyde — Benzyl alcohol — Sodium benzoate

Name of the reaction: Cannizzaro's reaction

41. a) Increasing order of acid strength is B<A<C

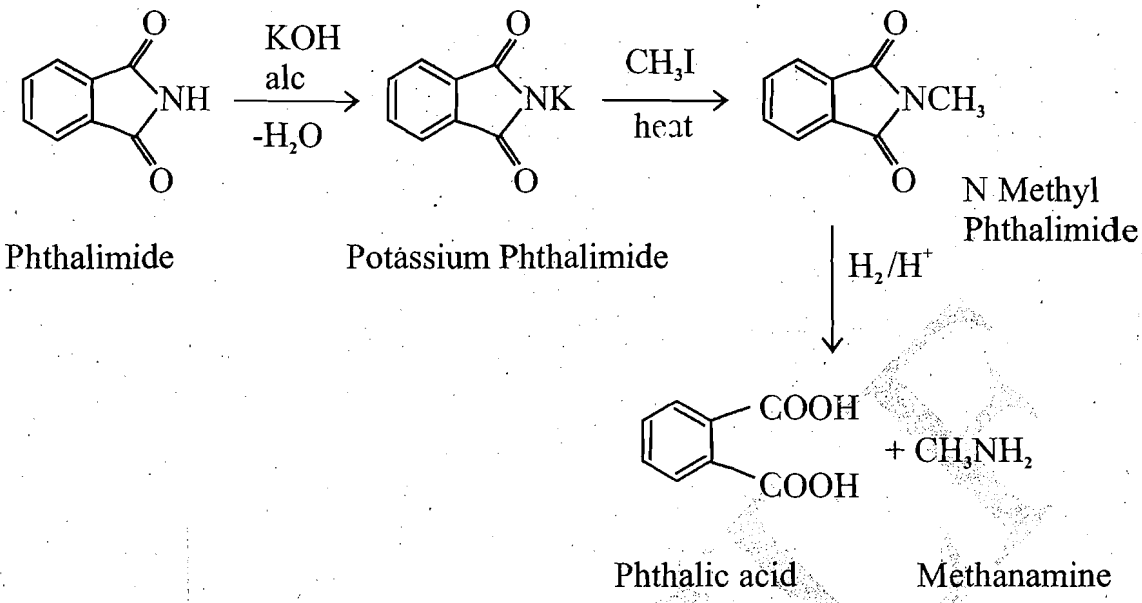
b) The process of removal of CO_2 from sodium salt of carboxylic acids using dry soda lime is called decarboxylation gives hydrocarbon.

$$R\text{-}COONa \xrightarrow[heat]{NaOH+CaO} R\text{-}H + Na_2CO_3$$

Reagent used for decarboxylation reaction is sodalime (NaOH+ CaO in the ratio 3: 1).

c) Chromium trioxide (CrO_3) in acidic medium is called Jones reagent

42. a)



b) (i)alcohol (ii) Iodobenzene

c) In 3^0 amines, there is no hydrogen on the nitrogen atom.

43.a) Loss of biological activity of protein by heating or change in pH in presence of salts is called denaturation. During denaturation of protein, secondary and tertiary structures destroyed. Primary structure remains intact.

b) i) Glucose on heating with HI and red phosphorus gives n-hexane. This shows that glucose contains 6 carbon atoms in a straight chain.

ii) Glucose reacts with hydroxylamine to give glucose oxime. This shows that glucose contains a carbonylgroup.

c) Polypeptide hormones- insulin/ glucagons.

Part - E

VII

44. $M_2 = \dfrac{K_1 \times W_2 \times 1000}{\Delta T_1 \times W_1}$

$M_2 = \dfrac{1.86 \times 0.6 \times 1000}{0.813 \times 21.7}$

$M_2 = 63.26\ g/mol$

K_f=1.8KKg/mol

W_2=0.6 g

W_1=21.7

$\Delta T_f = T^0_f - T_f$

=273-272.187=0.813K

45. 1 molal solution implies one mole of the solute dissolved in 1000g of water.

Number of moles of solute (n_B)= 1 mol

Number of moles of water (n_A) = $\dfrac{1000}{18} = 55.5mol$

Mole fraction of the solute = $\dfrac{1}{1+55.55}$ = 0.0177

Vapour pressure of solution = P^0_2X Mole fraction of Solute

= P^0_2X (1-Mole fraction of water) - 12.3 X (1-0.0177)

=12.3 X 0.982 = 12.08 kPa

46. $Ag^+ + 1e^- \rightarrow Ag$

IF 1 mol

96500 C $\longrightarrow$ 108g

96500 C deposits 108 g of Ag

$\therefore$ Charge required to deposit 0.42 g Q = $\frac{96500 \times 0.42}{108}$ = 375.27C

Q=It

$$t = \frac{Q}{I} = \frac{375.27}{3} = 125.09 \text{ seconds}$$

47.

$$k = \frac{l}{A} \times \frac{1}{R}$$

$$k = 1.15 \times \frac{1}{2.5 \times 10^3} = 4.60 \times 10^{-4} ohm^{-1} cm^{-1}$$

$$\Lambda_m = \frac{1000 \times k}{M}$$

$$\Lambda_m = \frac{1000 \times 4.60 \times 10^{-4}}{0.1} = 4.60 \ ohm^{-1} cm^2 mol^{-1}$$

48. (i) $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{30} = 0.0231 \text{ min}^{-1}$

(ii) $t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$

$$t = \frac{2.303}{0.0231} \log \frac{100}{100 - 75}$$

$$t = \frac{2.303}{0.0231} \log 4 = 60 \text{ minutes}$$

49. $$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} = \left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$E_a = \frac{2.303 R T_1 T_2}{T_2 - T_1} \log \frac{k_2}{k_1}$$

E_a = 44702.16 *J OR* 44.16*KJ*

****

Model Question Paper-2
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part- A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. A non-ideal solution with negative deviation was prepared by mixing 30ml chloroform and 50ml acetone. The volume of mixture will be
   a) > 80ml b) < 80ml c) =80ml d) ≥ 80ml
2. Standard electrode potential of SHE at 298 k is
   a) -0.76V b) 0.10V c) 0.34V d) 0.0V
3. Rust is a
   a) Hydrated Fe_2O_3 b) Hydrated Fe_3O_4 c) Hydrated FeO
   d) mixture of Fe_3O_4 and Fe_2O_3
4. In areaction $2A + B \rightarrow A_2B$, the reactant 'A' will disappear at
   a) Half the rate that B will decrease b) The same rate that B will decrease
   c) Twice the rate that B will decrease d) The same rate at A_2B will form
5. Which of the following statement is not correct for interstitial compounds
   a) They are hard b) Chemically active c) Have high melting point
   d) They retain metallic conductivity
6. Name the metal which possesses maximum number of oxidation states
   a) Chromium b) Zinc c) Manganese (d) Iron
7. The hardness of water is estimated by
   a) Conductivity method b) EDTA method c) Soda method
   d) distillation method
8. Chlorobenzene reacts with magnisium in dry ether to give a compound A. A is
   a) C_6H_5OH b) C_6H_5MgCl c) $C_2H_5CH_2MgCl$ d) $MgCl_2$
9. The compound which shows symmetrical ethers only is
   a) C_3H_8O (b) $C_4H_{10}O$ c) $C_5H_{12}O$ d) $C_6H_{14}O$

10. In the hydroboration-oxidation reaction, propene is treated with diborane followed by H_2O_2 and NaOH, the organic compound formed is
a) $H_3C\text{-}CH_2\text{-}OH$ b) $CH_3CH(OH)CH_3$ c) $H_3C\text{-}CH_2\text{-}CH_2\text{-}OH$
d) $(H_3C)_3C\text{-}OH$

11. Aldehyde which answers Cannizzaro's reaction does not contain
a) β-Hydrogen b) α-Hydrogen c) γ-Hydrogen d) δ-Hydrogen

12. Hinsberg's reagent is
a) Benzene sulphuryl chloride b) Chlorobenzene
c) Benzene sulphonyl chloride d) Benzene carbonyl chloride

13. Carbylamine reaction is answered by
a) Phenols b) Aldehyde c) 1^0-amines d) 2^0-amines

14. Which one of the following is a polysaccharide:
a) Starch b) Maltose (c)Fructose (d) Glucose

15. RNA contains
a) Ribose sugar and Thymine b) Ribose sugar and Uracil c) Deoxyribose sugar and Uracil d) Deoxyribose sugar and Thymine

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

(Rate Constant, Sodium benzoate, Nitrogen, one, Elimination, zero)

16. The sum of mole fractions of all the components in a binary mixture is equal to_____

17. The half life period for a zero-order reaction is inversely proportional to the _____

18. Dehydrohalogenation of ethyl chloride is an example of _____ reaction.

19. _____ is used as a food preservative.

20. The gas liberated when ethyl amine reacted with HNO_2 is _____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. Define solubility of a substance. What is the effect of pressure on solubility of solid in liquid?

22. Write rate expression for the reaction: $aA+bB \rightarrow cC+dD$

23. Identify the counter ion and chelating ligand in the complex $[Cr(en)_2(NH_3)_2]Cl_3$.

24. What is a Polyhalogen compound? Give an example.

25. What is Wolf-Kishner reduction? Write the general equation

26. How Glycylalanine (Gly-Ala) is formed? Give equation.

Part-C

IV. Answer any three of the following. Each question carries three marks : **3x3=9**

27. Mention any three characteristics of d-block elements.

28. Write chemical equations for the reactions involved in the manufacture of potassium dichromate from iron chromite ore.

29. What is formula of the product formed when lanthanoids (L_n) react with
i) Halogens(X_2) ii) Nitrogen (N_2) iii) Water (H_2O)

30. Write the IUPAC name of the complex compound $[Co(NH_3)_3]Cl_3$]. Draw Fac-mer isomers of it.

31. The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9BM. Predict the geometry of the complex ion.

31. Using valence bond theory account for the geometry and magnetic nature of $[Co(NH_3)_6]^+$ ion. (Atomic number of Co=27).

32. Explain synergic effect in the formation of metal carbonyls.

V. Answer any two of the following. Each question carries three marks: 2x3=6

33. What are ideal solutions? Mention any two conditions to form ideal solution?

34. Mention the condition at which Daniel cell is functions as electrolytic cell. Write the salient features at this condition.

35. Give any two differences between metallic and electrolytic conductors.

36. Explain the calculation of activation energy from Arrhenius equation by graphical method?

Part-D

VI. Answer any four of the following. Each question carries five marks: 4x5=20

37. a). Write the differences between S_N1 and S_N2 mechanism with respect to
i) Order of reaction
ii) Reactants on which rate of reaction depends
iii) configuration of the product.

b) Chloroform is stored in closed dark-coloured bottles. Why?

38. a)Explain the preparation of propan-1-ol from propene and name the rule involved.
b)Write the equation for the preparation of t-butyl methyl ether by Williamson's synthesis.

39. A hydrocarbon 'A' having molecular formula C_9H_{12} is oxidized in the presence of air to B. which on treating with dilute acid gives two commercial important organic compounds 'C' & 'D'. Organic compounds 'C' gives a characteristic colour with aqueous $FeCl_3$. When 'C' is treated with dilute nitric acid at 298K yields isomers 'D' & 'E', where 'D' is less volatile than 'E', hence which are separated by steam distillation. Deduce the structure of A, B, C, D and E.

40. a) Give names of the reagents (reactions) to bring about the following transformations:
i) benzene to acetophenone ii) benzene to benzaldehyde
iii) hex-4-enenitrile to hex-4-enal

b) Aldehydes are more reactive than ketones towards nucleophilic addition reaction. Explain by giving two reasons.

41. a) What happens when Sodium benzoate is heated with soda lime. What is the role of soda lime in this reaction?

b) How is acetic anhydride is prepared from acetic acid? Give equation.

42. a) Write the structures of main products formed when benzene diazonium chloride reacts with the following reagents: I) CuCN/KCN ii) H_2O iii) CH_3CH_2OH

b) pK_b value of aniline is quite high. Give reason.

43. a) What are reducing sugars? Sucrose is a non-reducing sugar. Give reason.

b) What is a nucleoside? Write any one functions of RNA.

c) Name any one vitamin that is stored in fat storing tissues.

PART-E

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. At 400K 1.5 g of an unknown substance is dissolved in solvent and the solution is made to 1.5L. Its osmotic pressure is found to be 0.3bar. Calculate the molar mass of the unknown substance. (Given $R=8.314X10^{-2}$ L bar K^{-1} mol^{-1})

45. Normal molar mass of a solute is 246 g mol^{-1} and observed molar mass of the solute is 346gmol^{-1}. Calculate the value of i? Comment on the state of the solute in the solvent.

46. The resistance of 0.01M acetic acid solution is found to be 2220 ohm when measured in a conductivity cell with cell constant 0.366cm^{-1}. Calculate conductivity and molar conductivity.

47. Calculate limiting molar conductivity of Calcium sulphate. Limiting molar conductivity of calcium and sulphate ions are 119.0 and 160.0 Scm^2mol^{-1} respectively.

48. For a reaction: $2NH_3(g) \xrightarrow[\Delta]{Pt} N_2(g)+3H_2(g)$, the rate constant $k = 3 X 10^3 molL^{-1}s^{-1}$.

What are the rates of production of N_2 and H_2 gas?

49. Calculate time taken to reduce 20$molL^{-1}$ reactant to 5 $molL^{-1}$ of reactant for the first order reaction has rate constant $1.15 X 10^{-3}s^{-1}$.

Answers

I.

1. b) <80ml
2. d) 0.0V
3. a) Hydrate Fe_2O_3
4. a) Half the rate that B will decrease
5. b) Chemically active
6. c) Manganese
7. b) EDTA method
8. b) C_6H_5MgCl
9. b) C_2H_6O
10. c) $H_3C\text{-}CH_2\text{-}CH_2\text{-}OH$
11. b) α-Hydrogen
12. c) Benzene sulphonyl chloride
13. c) 1^0-amines
14. a) Starch
15. b) Ribose sugar and Uracil

II.

16. One
17. Rate Constant
18. Elimination
19. Sodium benzoate
20. Nitrogen

III.

21. Solubility of a substance is its maximum amount that can be dissolved in a specified amount of solvent at specified temperature. Pressure does not have any significant effect on solubility of solids in liquids.

22. Rate law the expression in which reaction rate is given in terms of molar concentration of reactants with each term raised to some power, which may or may not be same as the stoichiometric coefficient of the reacting species in a balanced chemical equation.
    Rate expression for the reaction: $aA+bB \rightarrow cC+dD$ is
    Rate $\alpha[[A]^a [B]^b$ or Rate$= k[A]^a [B]^b$ where 'k' is rate constant

23. counter ion is Chloride or Cl^- ions. chelating ligand: en= -ethan-1,2-diamine

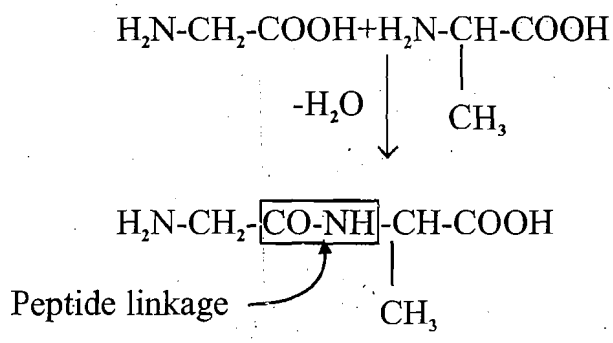
24. Carbon compounds containing more than one halogen atom are usually referred to as polyhalogen compounds.
    Example: dichloromethane, trichloromethane, triiodomethane, DDT, Freons, etc...

25. Aldehydes and ketones when treated with hydrazine give hydrazones which on heating with potassium hydroxide in ethylene glycol give hydrocarbons.

$$>C=O + H_2N\text{-}NH_2 \longrightarrow >C=N\text{-}NH_2 \xrightarrow[180^0]{\text{Ethylene Glycol + KOH}} > CH_2 + N_2(g)$$

Carbonyl Compound Hydrazine Hydrocarbon

26. When carboxyl group of glycine combines with the amino group of alanine forms dipeptide bond with the elimination of water molecule and forms dipeptide glycylalanine (Gly-Ala).



Glycylalanine (Gly-Ala)

IV.

27. 1. All are metals. Most of them are harder.
    2. They have higher melting points, boiling points and heats of vaporization than non-transitional elements.
    3. Their ions and their compounds are generally coloured.
    4. They form co-ordination compounds.
    5. They exhibit variable oxidation states.
    6. Many of these metals and their compounds are paramagnetic.
    7. Many of these metals and their compounds are catalysts.
    8. They form interstitial compounds and alloys.

28. **Step 1:**

$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

Step 2:

$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

Or

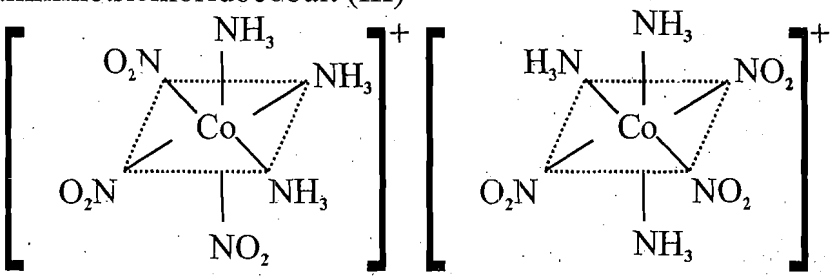
$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

Step 3:

$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$

29. i) LnX_3 ii) LnN iii) $Ln(OH)_3+H_2$

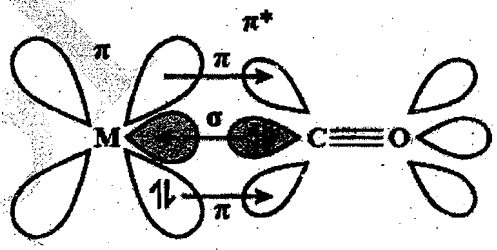
30. IUPAC name of complex compound $[Co(NH_3)_3]Cl_3$] is triamminetrichloridocobalt (III)



fac- mer-

31. The coordination number of Mn^{2+} ion is four, then the expected structures are either tetrahedral or square planar.
The magnetic moment of the complex ion is 5.9BM shows number of unpaired electrons in the d-orbitals are five, then the expected structure is tetrahedral due to ligand is weak field ligand and forms high spin complex.

32. In metal carbonyl, the metal-carbon bond possesses both σ and л - character.
The metal-carbon σ bond is formed by the donation of lone pair of electrons on the carbonyl carbon into vacant orbitals of metal.
The metal-carbon π bond is formed by the donation of a pair of electrons from a filled d-orbital of metal into the vacant antibonding π^* orbital of CO.
The metal to ligand bonding creates a synergic effect which strengthens the bond between CO and metal.



synergic bonding in metal carbonyls

33. Solutions which obey Raoult's law over the entire range of concentrations are known as ideal solutions.
Conditions to form ideal solution:
i) Enthalpy of mixing of the pure components to form the solution, $\Delta_{mix} H = 0$.
ii) Volume of mixing, $\Delta_{mix} V = 0$.
iii) An ideal solution will be formed when intermolecular force of attraction between the molecules of solute (A-A) and those between the molecules of solvent (B-B) are nearly equal to those between solute and solvent molecules (A-B).

34) When external potential E_{ext}>1.1V, the Daniel cell functions as an electrolytic cell.

When external potential E_{ext}>1.1V, the salient features of the cell are

1. Electrons flow from the copper rod to the zinc rod.
2. Current flows from zinc to copper electrode.
3. Copper dissolves at the copper electrode
4. Zinc is deposited at the Zinc electrode.

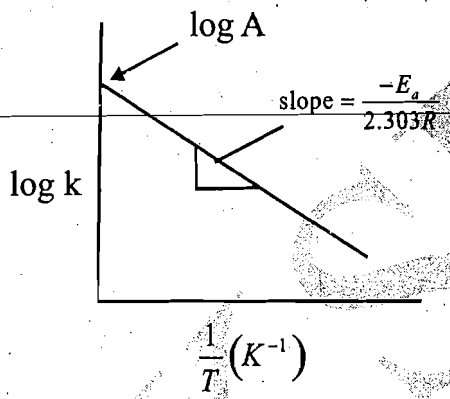
35.

Metallic conductors	Potassium Phthalimide
The conductivity is due to movement of electrons.	The conductivity is due to the movement of ions
They conduct electricity in solid state.	They do not conduct electricity in solid state, but conduct electricity in fused state or solution.
No chemical change takes place.	Chemical change takes place.

36. We know that $k = Ae^{\frac{-E_a}{RT}}$

By taking log on both sides $\ln k = \ln A - \frac{E_a}{R}\left(\frac{1}{T}\right) \Rightarrow \log_{10} k = \log_{10} A - \frac{E_a}{2.303R}\left(\frac{1}{T}\right)$

The plot of log k vs 1/T gives straight line. By calculating the slope from the graph,



$$\text{slope} = \frac{-E_a}{2.303R}$$

Energy of activation can be calculated as

E_a=-2.303×R×slope

VI.

37. a)

	S_{N^1} mechanism	S_{N^2} mechanism
Order of reaction	One (First order kinetics)	Two (Second order kinetics)
Reactants on which rate of reaction depends.	Only on concentration of alkyl halide (haloalkane)	On both the concentration of alkyl halide (haloalkane) and nucleophile.
Configuration of the product.	Both retention & Inversion of configuration	Inversion of configuration

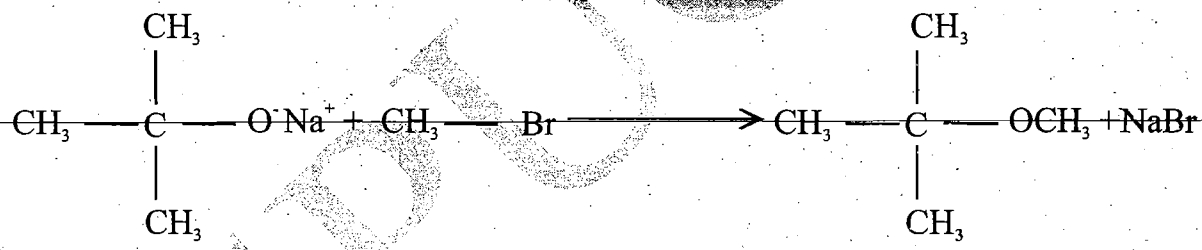
b) Chloroform is slowly oxidised by air in presence of light to a highly poisonous gas, carbonyl chloride, also known as phosgene. Therefore, chloroform is stored in closed dark-coloured bottles completely filled so that air is kept out.

$$2CHCl_3 + O_2 \rightarrow \underset{\text{phosgene}}{2COCl_2} + 2HCl$$

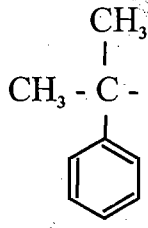
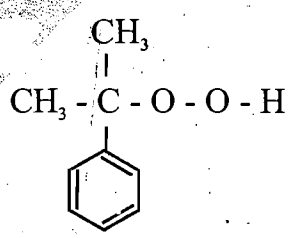
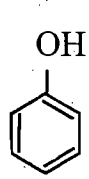
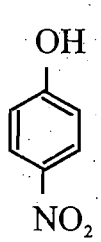
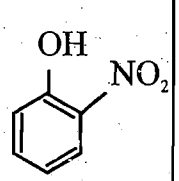
38. a) Propene react with water in the presence of acid as catalyst to form propanol. As the propene is unsymmetrical alkene, the addition takes place in accordance with Markovnikov's rule.

$$CH_3\text{-}CH{=}CH_2 + H_2O \overset{H^+}{\rightleftharpoons} CH_3\text{-}\underset{\displaystyle OH}{\underset{|}{CH}}\text{-}CH_3$$

b) When sodium t-butoxide is reacts with methyl bromide in dry ether medium gives t-butyl methyl ether.



39.

A	B	C	D	E
				
Cumene (isopropylbenzene)	Cumene hydroperoxide	Phenol	p-nitrophenol	o-nitrophenol

40. a)i) Acid chloride in the presence of anhydrous aluminium chloride (Freidel-Crafts acylation reaction)

ii) Carbon monoxide and hydrogen chloride in the presence of anhydrous aluminum chloride (Gatterman - Koch reaction)

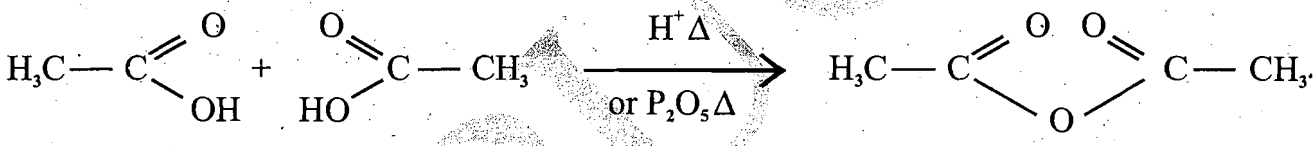
iii) diisobutylaluminium hydride or DIBAL-H

b) i. Due to steric effect (hindrance): -two large substituents in ketones hinders the approach of nucleophile to carbonyl carbon.

ii. Electronic effect:- two alkyl groups in ketone decrease electrophilicity of carbonyl carbon more effectively than in aldehydes.

41.a) When Sodium benzoate is heated with soda lime (NaOH + CaO in 3:1 ratio), it loses carbon dioxide to form benzene. Soda lime is decarboxylising reagent.

b) Carboxylic acids on heating with mineral acids such as H_2SO_4 or with P_2O_5 gives corresponding anhydride.



Ethanoic acid Ethanoic anhydride

c) The role of Sodium benzoate chemical in food as preservative.

42. a)

i) $C_6H_5CN + N_2$ ii) $C_6H_5OH + N_2 + HCl$

iii) $C_6H_6 + N_2 + CH_3CHO + HCl$

b) The amine ($-NH_2$) group is attached directly to the benzene ring, unshared electron pair on nitrogen atom to be in conjugation with the benzene ring and making it less available for protonation.

43.a) Carbohydrates which reduce Fehling's solution and Tollens reagent are known as reducing sugar.

Sucrose is formed by glycosidic linkage between C-1 of α-D-glucose and C-2 of β-D-fructose. Sucrose a non-reducing sugar because the reducing groups of glucose and fructose are involved in glycosidic bond formation.

b)A unit formed by attachment of a heterocyclic nitrogeneous base to 1' position of sugar moiety is known as nucleoside. A nucleoside contains only two basic components of nucleic acids, one is pentose sugar and the other is nitrogeneous base.

Functions of RNA: 1. Proteins are synthesised by RNA molecules in the cells.

2. RNA functions as an adapter in protein synthesis.

c) Vitamin A, D, E and K (any one)

VII

44. $$M_2 = \frac{W_2RT}{\pi V}$$

$$= \frac{1.5 \times 8.314 \times 10^{-2} \times 400}{0.3 \times 1.5} = 110.85 gram\ mol^{-1}$$

45. $$i = \frac{normal\ molar\ mass}{abnormal\ molar\ mass}$$

$$i = \frac{346 gmol^{-1}}{246 gmol^{-1}} = 1.41$$

Solute is undergoing dissociation.

46. $$\text{Conductivity (K)} = \frac{\text{Cell Constant}}{\text{Resistance (R)}} = \frac{0.366}{2220} = 1.648 \text{ X } 10^{-4} \text{ Scm}^{-1}$$

$$\text{Molar Conductivity } (\Lambda_m) = \frac{\text{Conductivity (K)}}{\text{Molarity (M)}} = \frac{1.648 \times 10^{-4} \times 1000}{0.01} = 16.485 Scm^2 mol^{-1}$$

47.

$CaSO_4 \rightarrow Ca^{2+} + SO_4^{2-}$

According to Kohlrausch law;

$$\Lambda^0_{m\ (CaSO_4)} = \lambda^{\infty}_{Ca^{2+}} + \lambda^{\infty}_{SO_4^{2-}}$$

$$= 119.0\ Scm^2 mol^{-1} + 16.485 Scm^2 mol^{-1}$$

$$= 279.0\ Scm^2 mol^{-1}$$

48. $2NH_3 \xrightarrow{Pt} N_2 + 3H_2$ is a zero order reaction.

In zero order reaction. Rate constant $k = 3 \times 10^3 molL^{-1}s^{-1}$.

$$\therefore -\frac{1}{2}\frac{d[NH_3]}{dt} = +\frac{d[N_2]}{dt} = +\frac{1}{3}\frac{d[H_2]}{dt}$$

Rate of production of $N_2 = \frac{d[N_2]}{dt} = 3 \times 10^3 molL^{-1}s^{-1}$

Rate of production of $H_2 = \frac{d[H_2]}{dt} = 3 \times 3 \times 10^3 molL^{-1}s^{-1} = 9 \times 10^3 molL^{-1}s^{-1}$

49. $$K = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

$$1.15 \times 10^{-3} = \frac{2.303}{t}\log\frac{20}{5} = \frac{2.303 \times 0.6020}{t} = \frac{1.386}{t}$$

$$t = \frac{1.386}{1.15 \times 10^{-3}} = 1.2 \times 10^3 = 1200\ Sec$$

****

Model Question Paper-3
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. Sprinkling of salt helps in clearing the snow-covered roads in hills. The phenomenon involved in the process is
   a) lowering in vapour pressure of snow
   b) depression in freezing point of snow
   c) melting of ice due to increase in temperature by putting salt
   d) increase in freezing point of snow.
2. Standard electrode potential of three metals X, Y and Z are -1.2 V, +0.5 V and -3.0 V, respectively. The reducing power of these metals will be:
   a) Y>Z>X b) X>Y>Z c) Z>X>Y d) X>Y>Z
3. Which of the following aqueous solution forms a conducting solution?
   a) Fructose b) Potassium hydroxide c) Alcohol d) Sugar
4. For a first order reaction, the plot of In R v/s t' gives a straight line with slope equal to
   a) k/2.303 b) -k/2.303 c) ln k/2.303 d) -k
5. Paramagnetic substance is magnetised in a magnetic field in the same direction, paramgnetism is due to presence of
   a) One or more unpaired electrons b) All paired electrons
   c) permanent spin and orbital motion d) Due to absence of unpaired electrons
6. The crystal field theory considers the metal-ligand bond to be a _____ bond.
   a) covalent b) ionic c) polar d) hydrogen
7. S_N1 reaction of optically active alkyl halides leads to
   a) Retention of configuration b) Racemic modification
   c) Inversion of configuration d) none of these
8. Which of the following is the least soluble in water?
   a) n-Butyl alcohol b) n-Pentyl alcohol c) n-Hexyl alcohol d) n-Heptyl alcohol

9. In vinylic alcohol, the hydroxy group (-OH) is attached to
   a) sp^3 b) sp^2 c) sp d) dsp^2
10. The reagent used during conversion of aldehyde to acetal by reacting with monohydric alcohol is
    a) Dry.HNO_3 b) Dry.H_2SO_4 c) Dry.HCl d) Dry H_3PO_3
11. Carboxylic acids exist in dimeric form even in vapour phase due to
    a) Hydrogen bond b) peptide bond c) ionic bond d) Metallic bond
12. What is the order of quantities of all isomers of nitroaniline formed on the reaction of aniline with nitric acid and sulphuric acid at 288K?
    a) ortho> meta> para b) para> ortho> meta
    c) para> meta > ortho d) meta> para> ortho
13. The basic strength of alkylamines does not depend on which of the following?
    a) Number of alkyl groups b) Size of alkyl groups
    c) Physical state of the amine d) Presence of an aromatic ring
14. Which of the following acids is a vitamin?
    a) Aspartic acid b) Ascorbic acid c) Adipic acid d) Saccharic acid
15. In DNA, the complementary bases are
    a) Adenine and Thymine; Guanine and Cytosine
    b) Uracil and Adenine; Cytosine and Guanine
    c) Adenine and Guanine; Thymine and Cytosine
    d) Adenine and Thymine; Guanine and Uracil

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

(orange, Edema, Four, Two, Hydrocarbon, yellow)

16. People taking a lot of salt develop swelling or puffiness of their tissues. This disease is called _____
17. For the reaction $2HI \rightarrow H_2 + I_2$, molecularity is _____
18. Number of series in the periodic table containing transition elements are _____
19. Grignard reagent react with any source of proton to give_____
20. The reaction between benzenediazonium chloride and phenol results in a coloured compound. _____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. 'Concentration of solution in terms of molality is preferred in comparison with molarity'. Give reason.
22. What are unimolecular reactions? Give an example.
23. Between Ti^{+4} and Ti^{+3}, which is more stable? Why?
24. What is racemic modification? A racemic mixture is optically inactive. Give reason.
25. Write the products formed when CH_3CHO reacts with the following reagents:
    a. Hydroxyl amine b. Tollen's reagent
26. What are the products of complete hydrolysis of nucleic acids?

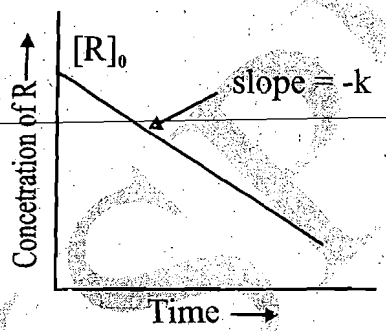
Part-C

IV. Answer any three of the following. Each question carries three marks : **3x3=9**

27. Transition metal forms of complex compounds. Give any three reasons.
28. Explain with chemical equation for reaction of potassium permanganate with iodides in the presence of acid solution and neutral solution separately.
29. Write the differences between lanthanoids and actinoids. With reference to (i) structural variability (ii) chemical reactivity and (iii) electronic configuration.
30. What is ambidentate ligand? Give an example. Name the type of structural isomerism that arises in the coordination compound containing such ligand.
31. Mention any three limitations of valence bond theory in co-ordination compounds.
32. Define crystal field splitting. Mention two factors on which crystal field splitting (Δ_0) depends.

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Define solution. Name the physical states of solute and solvent in the solution of iodine in CCl_4 at room temperature.
34. Define limiting molar conductivity. Name & State the law which helps to determine the limiting molar conductivity of weak electrolyte.
35. What is an inert electrode? Give an example. Name any one-half cell using this type of electrodes?
36. From the following graph,



What is the order of the reaction? Give an example for such reaction. What is the unit of rate constant 'K' for this type of reactions?

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a. Explain the nature of carbon-halogen (C-X) bond in haloalkanes.
    b. How aryl chlorides (Bromides) are prepared by electrophilic substitution of arenes. Give equation by taking toluene as an example.
38. a. Write the equations along with enzymes involved in the manufacture of ethanol from molasses.
    b. Mention the conditions used for the dehydrogenation of secondary alcohols to ketones. Write the chemical reaction.
39. a. Write the three reactions involved in mechanism of acid catalysed dehydration of ethanol to diethyl ether.

b. What happens when phenol treated with dil. Nitric acid?

40. Compound 'A' easily oxidises to 'B'($C_2H_4O_2$) on treatment with mild oxidizing agent Tollens' reagent. 'A' treated with dil.NaOH as a catalyst forms 'C', which on warming forms 'D'. 'B' on reacts with ammonia forms ammonium salt which on further heating at high temperature gives 'E'. Write all the reactions involved here.

41. a) What is the effect of an electron with drawing group on the acidity of carboxylic acids? Give reason.

b) Mention any two industries using formic acid.

42.a.Give reason:

i) In the isomeric amines, Butanamine has more boiling point than N,N-dimethylmethaneamine.

ii) Direct nitration of aniline is not possible.

iii) Aromatic primary amine cannot be prepared by Gabriel phthalimide synthesis.

b. How to convert an amide into primary amine having one carbon atom less than the starting compound? Name the reaction.

43. a. How glucose is commercially manufactured from starch?

b. What are native proteins? Give an example.

c. Name the vitamin responsible for the increase fragility of RBC's and muscular weakness.

PART-E

VII. Answer any three of the following. Each question carries three marks: 3x3=9

44. 12.6g of non-electrolyte is dissolved in 75g of water: The freezing point of this solution is 271.9K. Calculate molar mass of the solute. (Freezing point of pure water & molar depression constant of water are 273.15K & 1.86Kkgmol^{-1} respectively)

45. Calculate the molality of 20% (w/w) potassium iodide aqueous solution. Given atomic masses of potassium and iodine are 39gmol^{-1} and 127 gmol^{-1} respectively.

46. The conductivity of 0.01M acetic acid solution is found to be 1.648 X 10^{-4} Scm^{-1}. Calculate conductivity.

47. Calculate the mass of silver metal be deposited when 50A current passed through the solution of silver sulphate for an hour. (Given atomic mass of silver is 108gmol^{-1})

48. The rate constant of the first order reaction is 1.15 X 10^{-3}s^{-1}. Calculate time taken to reduce 5g reactant to 3g of reactant.

49. The rate of a specific reaction doubles when the temperature changes from 47°C to 57°C. Calculate the energy of activation. (R=8.314 JK^{-1}mol^{-1})

Answers

I.

1. d) increase in freezing point of snow.
2. c) Z> X>Y
3. b) KOH
4. d) -k
5. a) One or more unpaired electrons
6. b) ionic
7. b) Racemic modification
8. d) n-Heptyl alcohol
9. b) sp^2
10. c) Dry.HCl
11. a) Hydrogen bond
12. c) para>meta>ortho
13. d) Presence of an aromatic ring
14. b) Ascorbic acid
15. a) Adenine and Thymine; Guanine and Cytosine

II.

16. Edema
17. Two
18. Four
19. Hydrocarbon
20. Orange

III.

21. Because molarity of solution vary with temperature. But molality of solution doesn't depend on temperature.

22. The reaction in which only one reacting species is involved is called unimolecular reaction.

Example: i) Decomposition of ammonium nitrate: $NH_4NO_2 \rightarrow N_2 + 2H_2O$

ii) $PCl_5 \rightarrow PCl_3 + Cl_2$ iii) $H_2O_2 \rightarrow 2H_2O + \frac{1}{2} O_2$

iv) $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2} O_2$

23. Ti^{+4} ion is more stable than Ti^{+3} ion, because Ti^{+4} ions have 18 electrons and noble gas electronic configuration.

24. A mixture containing a pair of Enantiomers (d- and l- forms) of a compound in equal proportion will have zero optical rotation are called as racemic mixture or racemic modification. The optical rotation due to one isomer will be cancelled by the rotation due to the other isomer, hence racemic mixture is optically inactive.

25. a Acetaldehyde oxime b. Acetate ion + Sodium acetate + $Ag\downarrow + H_2O + NH_3$

26. The products of complete hydrolysis of nucleic acids are Pentose sugar, Phosphoric acid and Nitrogen containing heterocyclic compounds (Bases).

IV.

27. Transition metal forms of complex compounds due to
i) smaller size of transition metal ions
ii) larger ionic charges (Or high polarizing power i.e., high charge by size ratio)
iii) the availability of vacant d- orbitals for bond formation.

28. In the presence of acid solution potassium permanganate oxidises iodides to iodine:
$2MnO_4^{-1} + 16H^+ + 10I^- \rightarrow 2Mn^{+2} + 8H_2O + 5I_2$
In the presence of neutral solution potassium permanganate oxidises iodides to iodate:
$2MnO_4^{-1} + H_2O + I^- \rightarrow 2Mn^{+2} + 2HO^- + IO_3^-$

29. Differences between Lanthanoids and Actinoids:

LANTHANOIDS	ACTINOIDS
Both Lanthanoids forms a variety of structures. But lesser tendency of complex formation.	Both Actinoids forms a variety of structures. But stronger tendency of complex formation.
Lanthanbids are less reactive.	Actinoids are more reactive.
General outer electronic configuration Lanthanoids elements is $[Xe]4f^{1-14}5d^{0-1}6s^2$	General outer electronic configuration Actinoids elements is $[Rn]5f^{1-14}6d^{0-1}7s^2$

30. Monodentate ligands (ions or molecules) contains two different donor atoms (site) and either of the two ligetes in the complex is called Ambidentate ligand. OR Monodentate ligand co-ordinate with the one donor atom (site) with central metal ion but bind through two different atoms. Such monodentate ligands are called as Ambidentate ligand.
Example: nitrite ion (NO_2^-) ion, SCN^- ion, CN^- ion, etc
Linkage isomerism is arising in the compounds containing ambidentate ligand.

31. 1. VBT involves a number of assumptions.
2. VBT does not provides quantitative interpretation of magnetic data
3. The VBT theory fails to explain colour exhibited by coordination compounds.
4. VBT theory does not predict the relative stabilities of different complexes.
5. The VBT theory does not provides quantitative interpretation of the thermo dynamic or kinetic stabilities of coordination compounds.
6. The VBT theory fails to explain whether a complex of coordination number 4 is tetrahedral or square planar and cannot be exactly predicted.
7. The VBT theory fails to distinguish Weak and strong ligands.

32. The splitting of the degenerated levels (d-orbitals) due to presence of ligands in a definite geometry is known as Crystal - Field Splitting.

The crystal field splitting energy (Δ_0) depends on;

1. Field produced by the ligand (Strength of ligand).
2. Charge on the metal ion.

V

33. Solutions are homogeneous mixture of two or more than two components.Physical state of i) Solute: Solid ii) Solvent: Liquid

34. The conductivity of an electrolyte at infinite dilution is called limiting molar conductivity. The law which helps to determine the limiting molar conductivity of weak electrolyte is Kohlrausch's law. It states that 'the molar conductance of an electrolyte at infinite dilution is equal to the sum of the ionic conductances of respective cations and anions of electrolyte.

35. The electrode does not participate in the chemical reaction but provide their surface for oxidation or reduction reactions and for the conduction of electrons.

Example: Platinum (Pt) electrode, Gold (Au) electrode

Platinum (Pt) electrode is using in Hydrogen electrode (SHE).

36. The order of the reaction is Zero order reaction.

Unit of rate constant 'K' for zero order reactions is $molL^{-1}s^{-1}$

Example: i) Enzyme-catalysed reactions

ii) Thermal decomposition of HI on gold surface:

$$2HI \xrightarrow[\text{high temperature}]{Au} H_2 + I_2$$

iii) Decomposition of gaseous ammonia on hot platinum surface at high pressure:

$$2NH_3 \xrightarrow[\text{high temperature}]{Pt} N_2 + 3H_2$$

VI.

37. a. Halogen atoms are more electronegative than carbon, therefore, Carbon - halogen (C-X) bonds in haloalkanes are polar in nature.

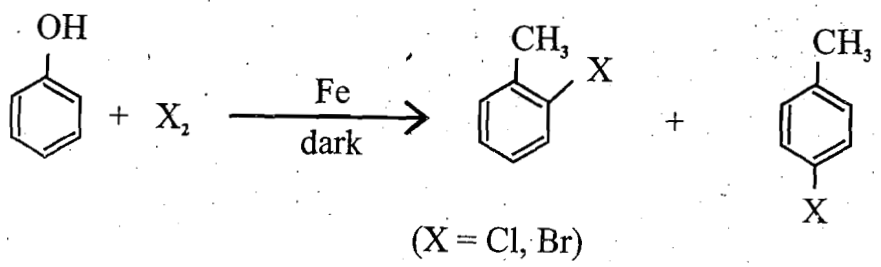
Carbon atom bears partial positive charge and halogen atom bears partial negative charge because shared pair of electrons are more towards halogen atoms.

$$\rangle C^{\delta+} — C^{\delta-} \langle$$

The polarity of C-X bond decreases as the electro negativity of halogen decreases.

The C-X bond length increases from C-F to C-I.

b. Toluene reacts with chlorine (Bromine) in the presence of halogen carrier such as Fe or I_2 or Lewis acid as catalyst such as $FeCl_3$ ($FeBr_3$), in cold and dark condition gives o-chlorotoluene (o-bromo toluene).



(X = Cl, Br)

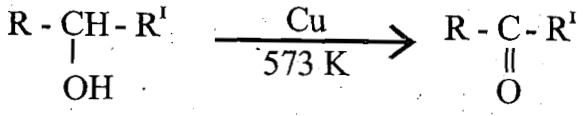
38. a.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase}} C_6H_{12}O_6 + C_6H_{12}O_6$$

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

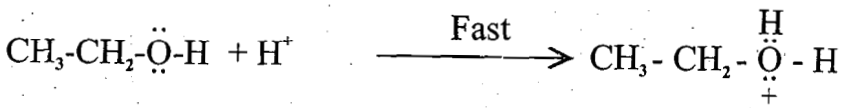
Enzymes involved in the manufacture of ethanol from molasses are Invertase and Zymase.

b. When the vapours of a secondary alcohol are passed over heated copper at 573K, dehydrogenation takes place and forms ketone.

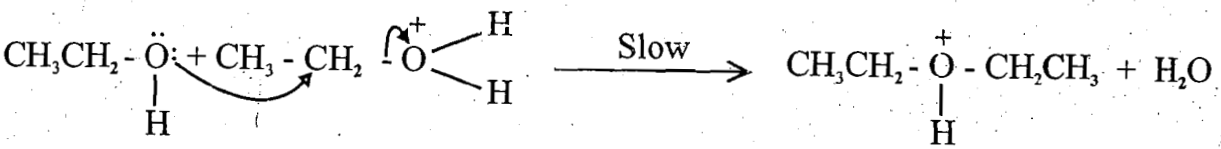


39. a. Formation of ether follows S_N2 mechanism.

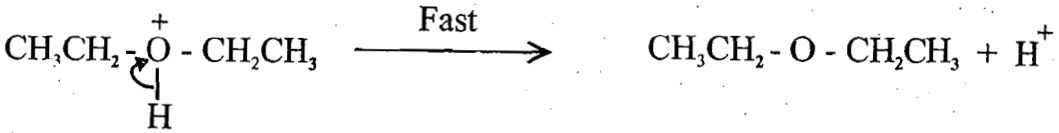
Step 1 - Protonation of



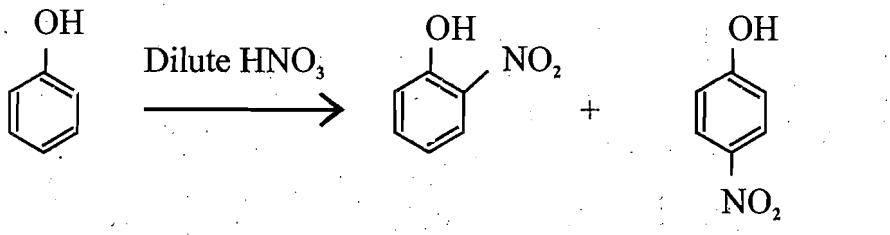
Step 2- Attack of nucleophile



Step 3- Loss of proton



b) Nitration: - With dilute nitric acid at low temperature (298K) phenol yields a mixture of ortho-nitrophenol & para-nitrophenol.



o-Nitrophenol p-Nitrophenol

40. $H_3C\text{-}CHO + [Ag(NH_3)_2]^+ + OH^- \longrightarrow H_3C\text{-}COO^- + 2Ag + 2H_2O + 4NH_3$

A B

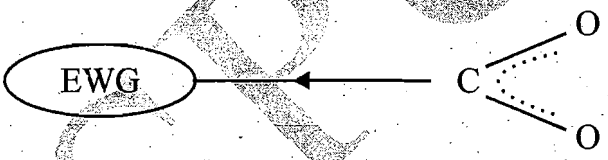
$2H_3C\text{-}CHO \xrightleftharpoons{\text{dil.NaOH}} CH_3\text{-}CH(OH)\text{-}CH_2\text{-}CHO \xrightarrow[-H_2O]{\Delta} CH_3\text{-}CH=CH\text{-}CHO$

A C D

$CH_3COOH + NH_3 \longleftrightarrow CH_3COO^-NH_4^+ + NH_3 \xrightarrow[-H_2O]{\Delta} CH_3CONH_2$

B Ammonium acetate E Acetamide

41.a) The presence of electron with drawing group increases the acidity of carboxylic acids by stabilizing the Carboxylate anion (conjugate base) through delocalization of negative charge by inductive and /or resonance effect.



Electron-withdrawing group (EWG) stabileses the carboxylate anion and strengthens the acid

b) Rubber, Textile, Dyeing, leather and electroplating industries.

42. a. i) Butanamine (Primary amines) are engaged in intermolecular Hydrogen b association between nitrogen of one and hydrogen of another molecule. But th intermolecular Hydrogen bonds association between nitrogen of one and hydrogen of another molecule is absent in N,N-dimethylmethaneamine.

ii) Direct nitration of aniline yields tarry oxidation products in addition to the nitro derivatives. The amine ($-NH_2$) group is protected by acetylation with acetic anhydride.

iii) Because aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.

b) Preparation of primary amines by treating an amide with Br; in an aqueous or ethanolic solution of NaOH. Amine formed contains one carbon less than that present in the amide.

$$R\text{-}\underset{\underset{O}{\|}}{C}\text{-}NH_2 + Br_2 + 4NaOH \longrightarrow R\text{-}NH_2 + Na_2CO_3 + 2NaBr + H_2O$$

This type of reactions is called Hoffmann Bromamide Degradation Reaction

43.a) Glucose is obtained by hydrolysis of starch by boiling it with dilute H_2SO_4, at 393 K, under pressure.

$$(C_6H_{12}O_6)_n + nH_2O \xrightarrow[393K,\ 2\text{-}3\ atoms]{H^+} nC_6H_{12}O_6$$

Starch or cellulose — Glucose

b. Protein found in a biological system with a unique three-dimensional structure and biological activity called a native protein.
Example: Albumin (Egg white), myosin, keratin, insulin, etc

c. Vitamin E responsible for the increase fragility of RBC's and muscular weakness.

VII

44. Depression of freezing point $\Delta T_f = T_f^0 - T$ =273.15-271.9=1.25K

$$M_2 = \frac{1000 \times w_2 \times K_f}{\Delta T_f \times w_1}$$

$$= \frac{1000 \times 12.6 \times 1.86}{1.25 \times 75} = 250 gmol^{-1}$$

45. 20% (w/w) potassium iodide aqueous solution means 20g of KI present in 80g of water.
Molecular mass of KI is (1X39)+(1X127)=166gmol^{-1}
Mass of solvent=80g=80 X 10^{-3} kg

$$\text{Number of moles of solute } (n_a) = \frac{Mass\ of\ solute}{Molecular\ Mass\ of\ KI} = \frac{20}{166} = 0.1205$$

$$\text{Molality (m)} = \frac{Number\ of\ Moles\ of\ solute}{Mass\ of\ in\ kg}$$

$$\text{Molality (m)} = \frac{0.1205}{80 \times 10^{-3}} = 1.506 molkg^{-1}$$

46.

$$\text{Molar conductivity } (\Lambda_m) = \frac{Conductivity(k)\times 1000}{Molarity(M)}$$

$$= \frac{1.648\times 10^{-4}\times 1000}{0.01}$$

$$= 16.485 Scm^2 mol^{-1}$$

47. Given I = 50A; t=1 hour = 1×60×60=3600 seconds

Q = It = 50×3600=180000C

$AgSO_4 \rightarrow Ag^+ + SO_4^{2-}$

$Ag^+ \rightarrow Ag$

1 F 1 mole

1×96500 X ⇒ 108 g of Ag deposits

96500 C → 108g Ag

18000 C → *x*g Ag

$$x = \frac{180000\times 108}{96500} = 201.5g$$

48.

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

$$t = \frac{2.303}{(1.15\times 10^{-3} s^{-1})}\times \log\frac{(5g)}{(3g)}$$

$$= \frac{2.303}{(1.15\times 10^{-3} s^{-1})}\log 5 - \log 3$$

$$= \frac{2.303}{(1.15\times 10^{-3} s^{-1})}(0.6990 - 0.4771)$$

t = 444 seconds

49. Given $T_1 = 47+273 = 320K$; $T_2 = 57+273 = 330K$; $K_2/K_1 = 2$

$$\log\frac{k_2}{k} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log 2 = \frac{E_a}{2.303\times 8.314}\left[\frac{330-320}{330\times 320}\right]$$

$$E_a = \frac{0.3010\times 2.303\times 8.314\times 320\times 330}{10}$$

$$E_a = 60,860 Jmol^{-1} = 60.86 KJmol^{-1}$$

****

Model Question Paper-4
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. The atmospheric pollution is generally measured in the units of
   a) mass percentage b) volume percentage c) volume fraction d) ppm
2. The electric charge for electrode decomposition of one gram equivalent of a substance is
   a) one ampere per second b) 96500 coulombs per second
   c) one ampere for one hour d) charge on one mole of electrons
3. Fused NaCl on electrolysis, at cathode gives _____.
   a) Chlorine b) Sodium c) Sodium amalgam d) Hydrogen
4. Radioactive disintegration is an example of
   a) zero order reaction b) first order reaction
   c) second order reaction d) third order reaction
5. General electronic configuration of Lanthanoids is
   a) $[Rn]\ 5f^{1-14}\ 6d^{0-1} 7s^2$ b) $[Xe]\ 4f^{1-14}\ 5d^{0-1}\ 6s^{1-2}$
   c) $[Kr]\ 4f^{0-14}\ 5d^{0-1}\ 6s^2$ d) $[Xe]\ 4f^{1-14}\ 5d^{0-1}\ 6s^2$
6. Metal present in chlorophyll is
   a) Zinc b) Magnesium c) Calcium d) Sodium
7. The reaction of alkyl chlorides with alcoholic KOH is an example of
   a) Substitution reaction b) Elimination reaction
   c) Addition reaction d) Condensation reaction
8. How are alcohols prepared from haloalkanes?
   a) By treating with concentrated H_2SO_4 b) By heating with aqueous NaOH
   c) By treating with a strong reducing agent d) By treating with Mg metal

9. R-O-R, where R represent an alkyl or aryl group is the general formula of which compound?
   a) Ether b) Ester c) Aldehyde d) Ketone
10. The IUPAC name of H-CHO is
   a) Formic acid b) Formaldehyde c) Methanal d)Methanol
11. In Stephen Reaction.
   a) Alcohols are converted into aldehydes
   b) Carboxylic acid is converted into aldehydes
   c) Nitrile compounds are converted into aldehydes
   d) Haloalkanes are converted into aldehydes
12. Amines are generally _____ in nature.
   a) electrophilic b) acidic c) basic d) neutral
13. Benzene diazonium chloride on hydrolysis gives
   a) Phenol and N_2 b) Diazonium salt c) Hydrazo compound d) Benzene
14. Which of the following reactions of glucose can be explained only by its cyclic structure?
   a) Glucose forms penta acetate.
   b) Glucose reacts with hydroxylamine to form an oxime.
   c) penta acetate of glucose does not react with hydroxylamine.
   d) Glucose is oxidized by nitric acid to gluconic acid.
15. Which of the following B group vitamins can be stored in our body?
   a) Vitamin B1 b) Vitamin B2 c) Vitamin B6 d) Vitamin B12

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

(Halothane, Less, 1^0 - amines, 513K, Slowest step, 3^0 - amines)

16. At 293K K_H value of N_2 is 76.48 kbar and O_2 is 34.86 kbar temperature, nitrogen gas is _____ soluble in water than oxygen.
17. In a complex reaction, the rate of reaction depends on_____.
18. The temperature at which $KMnO_4$ decomposed to O_2 is _____
19. _____ is used as an anaesthetic during surgery.
20. Benzene sulphonyl chloride will not give precipitate with _____.

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. Give an example each for natural and artificial Semipermeable membrane (SPM).
22. Define rate of a reaction? What is the unit of rate of reaction?
23. Using abbreviations of ligand 'en', identify the number of donor sites and write the formula of the Ligand.
24. Arrange the following haloalkanes in the increasing order of boiling points for:

   i) R-Cl, R-I, R-Br, R-F ii) 1^0-, 2^0- and 3^0 - butyl bromide

25. Name the products formed when the following compound are hydrolysed with aqueous Mineral acids. i) acetal ii) ethylene glycol ketal

26. Mention any two limitations of open chain structure of glucose.

Part-C

IV. Answer any three of the following. Each question carries three marks : 3x3=9

27. In aqueous solution, why Cu^{+} compounds are unstable and Cu+ changes to Cu^{2+}. What special name is given to such type of reactions?

28. "The chromates and dichromates are inter convertible by the change in pH of medium." Why? Give chemical equations.

29. The best use of lanthanoids is Mg-based alloy to produce bullets, shell and lighter flint. Name the alloy used and give its composition.

30. Write the IUPAC name of complex compound $Fe_4[Fe(CN)_6]_3$. Identify the co-ordination sphere and counter ion in the complex.

31. How does the magnitude of the Δ_0 decides the complexes are the high spin and low spin complexes.

32. Name the complex compounds are applicable in
    i) Platinum complex used to inhibit the growth of tumours.
    ii) Electroplating of silver
    iii) Rhodium complex used for the hydrogenation of alkenes.

V. Answer any two of the following. Each question carries three marks: 2x3=6

33. Derive the relation between elevation in boiling point and the molar mass of a non-volatile solute.

34. Draw a neat labeled diagram of H_2- O_2 fuel cell. Write the reaction occurs at cathode of the cell. Mention one application of this cell.

35. Write any two differences between Galvanic cell and Electrolytic cell.

36. What is the effect of catalyst on Gibbs energy (Δ G) of a reaction and equilibrium constant? Draw a Graph of potential energy v/s reaction coordinate to show the effect of catalyst on activation energy.

Part-D

VI. Answer any four of the following. Each question carries five marks: 4x5=20

37. a. What are ambident nucleophiles? Give an example & write the general equation for the reaction of alkyl halides with this type of nucleophiles.

    b. Give reason.
    i) The bond length of C-Cl bond is larger in haloalkanes than that in haloarenes.
    ii) Aryl halides undergo electrophilic substitution reaction slowly compared to benzene.

38. a. Describe the Hydroboration oxidation reaction of alkene with example.

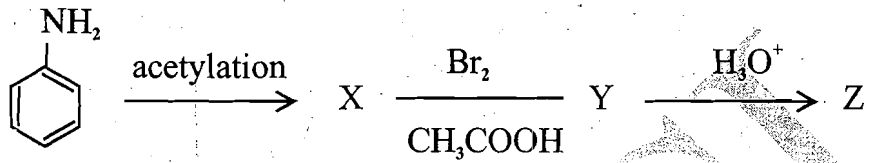
    b. Anisole react with hydrogen iodide to form phenol, but not methanol. Give reason.

39. An organic compound A having molecular formula C_6H_6O gives a white precipitate with aqueous Br_2. When 'A' is treated with NaOH, compound 'B' is obtained. Compound 'B' on treated with CO_2 at 400k under pressure followed by acidification gives, compound 'C' which reacts with acetyl chloride in acid medium to form 'D', which is a popular pain killer. Deduce the structure of A,B, C and D.
What is the common name of Drug D?

40. a) Explain the preparations of ketones from acetyl chlorides.
b) Write chemical composition of Tollen's reagent. Name the carbonyl compound answer for Tollen's Test.

41. a. Give the equations for the conversions of ethanoic acid to ethanoic anhydride.
b. Explain esterification reaction and write the equation.

42. a. Identify the products X,Y and Z in the following conversion.



b. Write chemical equation for benzene diazonium chloride reacts with phenol in basic medium? Mention the colour of the product.

43.a. Name the naturally occurring α – amino acid that is optically inactive. Write the Zwitter ion form of this α – amino acid.
b. Water soluble vitamins must be supplied regularly in diet. Give reason. Name one such vitamin.
c. Which is the nitrogen containing heterocyclic compound (base) forms hydrogen bonds with guanine in DNA.

PART-E

VII. Answer any three of the following. Each question carries three marks: 3x3=9

44. Calculate the molarity of 9.2g of ethanol in 750g of water.
45. Solubility of a gas in water is 0.001m at STP; determine its Henry's law Constant.
46. Calculate the EMF of the cell for the reaction:

$$Mg_{(s)} + 2Ag^{+}_{(0.0001M)} \rightarrow Mg^{2+}_{(0.001M)} + 2Ag_{(s)}$$

Given: $E^0_{(Mg^{2+}/Mg)} = -2.37V$ & $E^0_{(Ag^{+}/Ag)} = 0.80V$

$\left[F = 96487 Cmol^{-1} \text{ \& } \log 10^5 = 5\right]$

47. 0.001028M acetic acid solution has a conductivity of $4.95X10^{-5}$ Scm^{-1}. Its $\lambda^{\circ}m$ is 390.5 Scm^2mol^{-1}. Calculate the degree of dissociation of acetic acid.
48. The rate constant of a certain reaction is $10min^{-1}$. Calculate half-life period of this reaction in Seconds?
49. The rate of chemical reaction quadruples for an increase of temperature 303K from 323K. Calculate energy of activation of the reaction assuming that it does not change with temperature.

Answers

I.

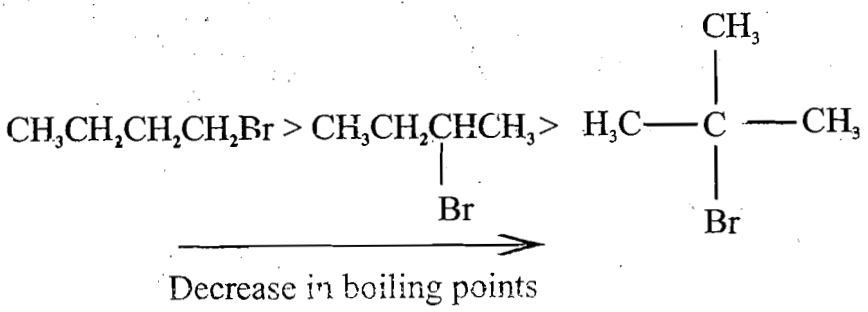
1. d) ppm
2. d) charge on one mole of electrons
3. b) Sodium
4. b) first order reaction
5. d) $[Xe]\ 4f^{1\text{-}14}\ 5d^{0\text{-}1}\ 6s^2$
6. b) Magnesium
7. b) Elimination reaction
8. b) By heating with aqueous NaOH
9. a) Ether
10. c) Methanal
11. c) Nitrile compounds are converted into aldehydes
12. c) basic
13. a) phenol and N_2
14. c) pentaacetate of glucose does not react with hydroxylamine.
15. d) Vitamin B_{12}

II.

16. Less
17. Slowest step
18. 513K
19. Halothane
20. 3^0amines

III.

21. Natural Semipermeable membrane (SPM) is pig's bladder.
    Artificial Sempermeable membrane (SPM) is cellophane.
22. The rate of change in concentration of the reactant or product (with respect to the change in time) at any instant of time.
23. en= ethylene diamine or ethane-1,2-diamine
    Number of donor sites: TWO or 2
    Formula of the ligand: $H_2N\text{-}CH_2\text{-}CH_2\text{-}NH_2$
24. i) R-F< R-Cl< R-Br< R-I
    ii) 3^0-butyl bromide < 2^0-butyl bromide < 1^0-butyl bromide



25. i) Acetal gives aldehyde and alcohol
ii) Ethylene glycol ketal gives ketones and ethylene glycol

26. Limitations of open chain structure of glucose are
1. Glucose does not give Schiff's test.
2. Glucose does not form the hydrogen sulphite addition product with $NaHSO_3$.
3. Glucose exists in two different crystalline forms i.e., α - & β - form.
4. The penta acetate of glucose does not react with hydroxylamine indicating the absence of Free-CHO group.

IV.

27. Cu^{2+} is more stable than Cu^{+} in aqueous medium because more negative

$$\Delta_{hyd}H^0 \text{ of } Cu^{2+}_{(aq)} \text{ than } Cu^{+}_{(aq)}$$

which more than compensates for the second ionization enthalpy of copper.

$$2Cu^{+} \rightarrow Cu^{2+} + Cu$$

This type of reaction is called Disproportionation reaction.

28. The dichromate ion CrO_7^{2-} exists in equilibrium with chromate CrO_4^{2-} ion at pH =4.However, by changing the pH, they can be inter-converted.

$$2CrO_4^{2-} \underset{\text{Alkali}}{\overset{\text{Acid}}{\rightleftharpoons}} 2HCrO_4^{-} \underset{\text{Alkali}}{\overset{\text{Acid}}{\rightleftharpoons}} Cr_2O_7^{2-}$$

Chromate	Hydrogen	Dichromate
(Yellow)	Chromate	(Orange)

29. The best use of lanthanoids is Mg-based alloy to produce bullets, shell ad lighter flint is Misch metal.

The alloys of Lanthanoids are Misch-metals consist of Lanthanoid metals (~95%), iron (~5%) and traces of S, C, Ca & Al.

30. IUPAC name of complex compound $Fe_4[Fe(CN)_6]_3$ is Iron (III) hexacyanidoferrate(II)

Co-ordination sphere in the complex is $[Fe(CN)_6]_3^{4-}$

Counter ion in the complex is Fe^{3+}

31. The relative magnitude of crystal field splitting Δ_0 and pairing energy (P= the energy required for electron pairing in a single orbital) energy decides and high spin and low spin complexes.

i) Ligand for which $\Delta_0 > P$ are known as strong field ligands and forms low spin complexes.

ii) Ligand for which $\Delta_0 < P$ are known as weak field ligands and forms high spin complexes.

32. i) Cis-platin is Platinum complex used to inhibit the growth of tumours.
ii) Solution of the complex $[Ag(CN)_2]^-$ is used electroplating of silver
iii) Rhodium complex $[(Ph_3P)_3RhCl]$ is used for the hydrogenation of alkenes.

V

33. For dilute solution, the elevation in boiling point is directly proportional to the molal Concentration 'm' of the solute in solution.

$$\Delta T_b \ \alpha \ m$$

$$\Delta T_b = K_b m \quad \text{----(1)}$$

Where, m= Molality (number of moles of solute per Kg of solution)
K_b= Proportionality constant known as Boiling Point Elevation Constant.
But,

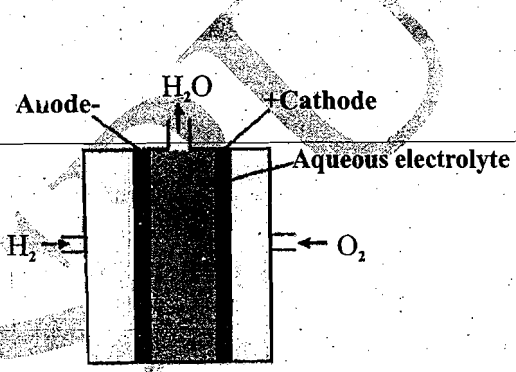
$$m = \frac{1000 \times W_2}{M_2 W_1} \quad \text{----(2)}$$

From equation (1) & (2)

$$\Delta T_b = k_b \ \frac{1000 \times W_2}{M_2 W_1}$$

Where, W_2= Mass of solute, M_2= Molar mass of solute and
W_1= Mass of solvent K_b- ebulioscopic constant.

34.



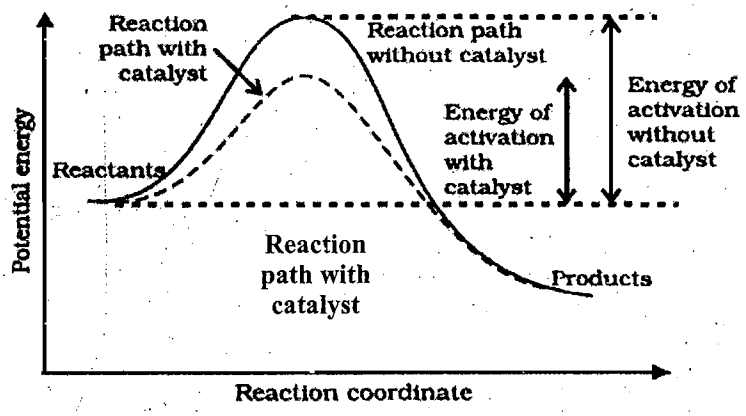
Reaction at cathode: $O_2(g) + 2H_2O(I) + 4e^- \rightarrow 4OH^-(aq)$
Application of H_2-O_2 fuel cell:
1. To provide electrical power in the Apollo space Programme.
2. Automobiles (on the experimental basis).

35.

Galvanic cell	Electrolytic cell
Cell converts chemical energy of redox reaction is converted into electrical energy.	Cell uses electrical energy to do chemical reactions.
Spontaneous red-ox chemical reaction takes place producing electrical current.	Non-spontaneous chemical reaction takes place by passing electric current.
Electrons flow from the anode to the cathode.	Electrons flow from the cathode to the anode.
Current flows from cathode to anode.	Current flows from anode to cathode.

The two electrodes are placed in two different solutions, which are separated by a porous barrier or salt bridge.	Both the electrodes are placed in a single solution.
Anode is negatively charged.	Anode is positively charged.
Cathode is positively charged.	Cathode is negatively charged.
Ex: Daniel cell, dry cell etc.,	----

36. Catalyst does not alter Gibbs energy (ΔG) of a reaction.
Catalyst does not alter equilibrium constant of a reaction. But it helps in attaining the equilibrium faster. Because it catalyses' the forward as well as the backward reactions to the same extent so that the equilibrium state remains same but reached earlier.



VI.

37. a) Nucleophile such as $C\equiv N:$ and $O=N-O^-$ ions attacks the electron deficient carbon atom through Different nucleophilic centers. Such Nucleophile is called ambident Nucleophile.

Example: Cyanides CN^- : and $O=N-O^-$ ions; etc

General equation: $R\text{-}X + KNO_{2(alcoholic)} \rightarrow R\text{-}O\text{-}N=O + KX$

$R\text{-}X + AgNO_{2(alcoholic)} \rightarrow R\text{-}NO_2 + AgX$

b. i) In haloarenes, the benzene ring undergoes resonance and as a result, the C-X bond acquires a partial double bond character.

ii) Halogen atom attached to the benzene shows – I effect & has tendency to withdraw electrons from benzene ring, ring gets deactivated slowly compared to benzene.

38. a. Alkenes react with diborane to give trialkyl borane, which on oxidation with hydrogen peroxide in alkali give alcohol. This reaction is called hydroboration – oxidation. During this reaction, boron atom of diborane gets attached to the sp^2 carbon carrying greater number of hydrogen atoms.

Example,

$$3CH_3\text{-}CH=CH_2 + (H\text{-}BH_2)_2 \xrightarrow{THF} (CH_3\text{-}CH_2\text{-}CH_2)_3B$$

Propene Diborane

$$(CH_3\text{-}CH_2\text{-}CH_2)_3B \xrightarrow[3H_2O_2,\ OH^-]{H_2O} 3CH_3\text{-}CH_2\text{-}CH_2\text{-}OH + B(OH)_3$$

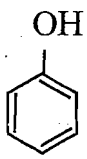
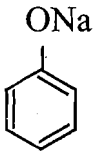
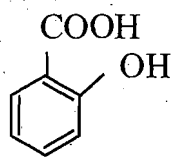
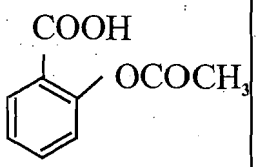
Propane-1-ol Boric acid

b. When anisole is treated with hydrogen iodide undergoes protonation of anisole to forms methyphenyl oxonium ion.

The bond between O-CH_3 is weaker than the bond between O-C_6H_5 because the carbon of phenyl group is sp^2 hydridised and there is a partial double bond character.

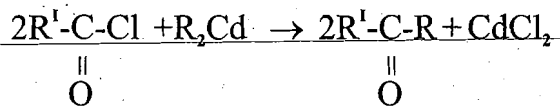
Therefore, the attack by iodide (I-) ion breaks O-CH_3 bond to form CH_3I.

39.a

A	B	C	D
	 Sodium Phenoxide	 Salicylic acid	 Acetyl salicylic acid (aspirin)
Phenol	Sodium Phenate	2-hydroxybenzoic acid (Salicylic acid)	Acetyl salicylic acid (aspirin)

Common name of drug D is Aspirin.

40. a. Treatment of acyl chlorides with dialkylcadmium, prepared by the reaction of cadmium chloride with Grignard reagent, gives ketones.

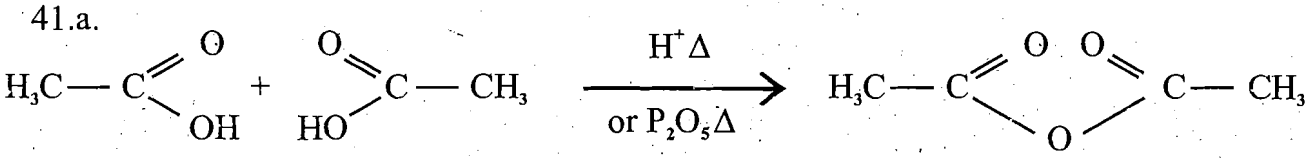


$$2R^{I}\text{-}\underset{\underset{O}{\|}}{C}\text{-}Cl + R_2Cd \rightarrow 2R^{I}\text{-}\underset{\underset{O}{\|}}{C}\text{-}R + CdCl_2$$

b. Tollens' reagent is freshly prepared ammoniacal silver nitrate solution. $2[Ag(NH_3)_2]^+$

The carbonyl compound answer for Tollens' test is aldehydes.

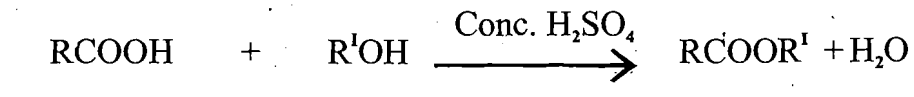
41.a.



$$H_3C\text{—}\underset{\underset{OH}{|}}{\overset{\overset{O}{\|}}{C}} + \underset{\underset{HO}{|}}{\overset{\overset{O}{\|}}{C}}\text{—}CH_3 \xrightarrow[\text{or } P_2O_5\Delta]{H^+\Delta} H_3C\text{—}\overset{\overset{O}{\|}}{C}\text{—}O\text{—}\overset{\overset{O}{\|}}{C}\text{—}CH_3$$

Ethanoic acid — Ethanoic anhydride

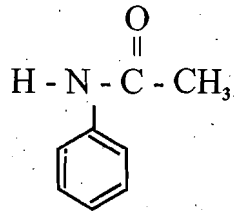
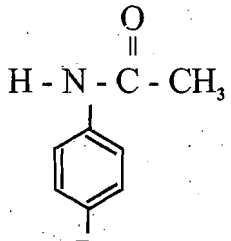
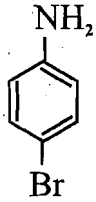
b. Carboxylic acids are heated with alcohols or phenols in presence of concentrated sulphuric acid or dry HCl gas to give ester. This reaction is called esterification.



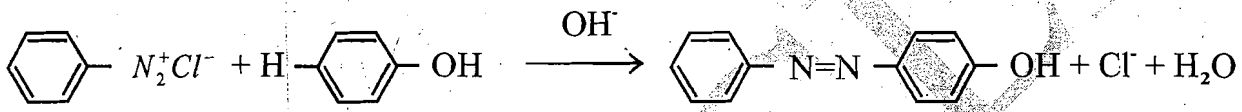
$$RCOOH + R^{I}OH \xrightarrow{\text{Conc. } H_2SO_4} RCOOR^{I} + H_2O$$

Carboxylic acid — Alcohol — Ester

42. a.

X	Y	Z
 Acetanilide	 (Major)	 4 - Bromoaniline

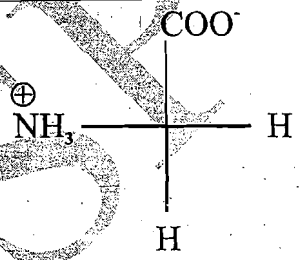
b. Benzene diazonium chloride reacts with phenol to give azo dyes . these reactions are called coupling reactions.



Benzene diazonium Chloride | Phenol | p-Hydroxy-azobenzene (orange dye)

The colour the product p-hydroxy azobenzene is orange colour.

43.a. Glycine the naturally occurring α – amino acid that is optically inactive.
The Zwitter ion form of α – amino acid (Glycine) is



b. Water soluble vitamins must be supplied regularly in diet because they are readily excreted in urine and cannot be stored in our boby.
Water soluble vitamins are vitamin B (B_1, B_2 & B_6) and vitamin C.

c. Cytosine is the nitrogen containing heterocyclic compound (base) forms hydrogen bonds with guanine in DNA.

VII

44. Mass of solute=9.2g Mass of solvent=80g=80X 10^{-3}kg

Molecular mass of ethanol C_2H_5OH) is (2 X 12) + (6 X 1) + (1 X 16) = 46gmol^{-1}

$$\text{Number of molecs of solute } (N_B) = \frac{Mass\ of\ solute}{Molecular\ mass} = \frac{9.2}{46} = 0.2$$

$$\text{Molarity (M)} = \frac{Number\ of\ moles\ of\ solute}{Volume\ of\ solution\ in\ litre} = \frac{0.2}{750\times10^{-3}} = 0.27 molL^{-1}$$

45. Solubility of gas = 0.001 moles gas present in 1000g water.
Pressure at STP = 0.987 bar Consider gas = A & water = B

$$\text{Number of moles of water (B)} = \frac{Mass\ of\ B}{Molar\ Mass\ of\ B} = \frac{1000}{18} = 55.55$$

$$\text{Mole fraction of gas } (X_A) = \frac{n_A}{n_A + n_B} = \frac{0.001}{0.001 + 55.55} = 1.79\times10^{-5}$$

According to Henry's law; $p=K_H X$

$0987bar = K_H X 1.79 X 10^{-5}$

$$K_H = \frac{0.987bar}{1.79\times10^{-5}} = 55.14\ bar$$

46.

$$E^0_{cell} = E^0_{(Ag^+/Ag)} - E^0_{(Mg^{2+}/Mg)} = 0.80V - (-2.37V) = 3.17V$$

The Nernst equation is

$$E_{cell} = E^0_{cell} - \frac{RT}{nF}\ln\frac{[Mg^{2+}]}{[Ag^+]}$$

$$E_{cell} = 3.17V - \frac{0.059V}{n}\log\left[\frac{(0.001)}{(0.0001)^2}\right]$$

$$E_{cell} = 3.17V - \frac{0.059V}{2}\times5$$

$$E_{cell} = 3.17V - 0.147V$$

$$E_{cell} = +3.023V$$

47.

$$\text{Molar Conductivity } (\Lambda_m) = \frac{Conductivity(k)\times1000}{Molarity(M)}$$

$$= \frac{4.95\times10^{-5}\times1000}{0.001028}$$

$$= 48.15 Scm^2 mol^{-1}$$

$$\text{Degree of Dissociation} = \frac{\textit{Molar Conductivity}}{\textit{Limiting Molar Conductivity}} = \frac{\Lambda_m}{\Lambda_m^0}$$

$$\alpha = \frac{485 Scm^2 mol^{-1}}{390.5 Scm^2 mol^{-1}}$$

$$\alpha = 0.1233$$

$$\text{Dissociation constant } K = \frac{c\alpha^2}{1-\alpha}$$

$$= \frac{0.001028 molL^{-1} \times (0.1233)^2}{1 - 0.1233}$$

$$= 1.78 \times 10^{-5} molL^{-1}$$

48. Rate constant = $10\ min^{-1}$

Since unit of rate constant is min^{-1} then the order of reaction is first order.

$$t_{1/2} = \frac{0.693}{k}$$

$$t_{1/2} = \frac{0.693}{10\ min^{-1}}$$

$$t_{1/2} = 0.0693\ \text{min} = 0.0693 \times 60 seconds = 4.158 seconds$$

49. Given $K_2 = 4K_1$; $T_1 = 303K$ & $T_2 = 323K$; $R = JK^{-1}mol^{-1}$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log 4 = \frac{E_a}{2.303 \times 8.314}\left[\frac{20}{303 \times 323}\right]$$

$$E_a = \frac{0.6021 \times 2.303 \times 8.314 \times 303 \times 323}{20}$$

$$E_a = 56414.11J \text{ or } 56.414kJ$$

****

Model Question Paper-5
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. Which of the following concentration term is dependent on temperature?
   a. PPM b. Mole fraction c. Molality d. Molarity
2. The charge on one mole of electrons is equal to
   a. 95647Cmol^{-1} b. 96487Cmol^{-1} c. 96600Cmol^{-1} d. 94500Cmol^{-1}
3. The complex formed by ammonia with Zn^{2+} ions in the dry cell is
   a. $[Zn(NH_3)_4]^+$ b. $[Zn(NH_3)_4]^{2+}$ c. $[Zn(NH_3)_2]^+$ d. $[Zn(NH_3)_2]^{2+}$
4. Radioactive decay of nuclei is an example of
   a. Zero order reaction b. First order reaction
   c. second order reaction d. half order reaction
5. Which of the d-block element is not regarded as transition element?
   a. Co b. Cd c. Cn d. both b and c
6. Identify the incorrect statement.
   a. Ligands can act as Lewis acids b. Ligands can act as Lewis base.
   c. Ligand can be unidentate, bidentate and polydendate
   d. A bidentate ligand can cause chelation
7. The halogen exchange method preferred for the preparation of alkyl iodides is
   a. Finkelstein reaction b. Swartz reaction c. Wurtz reaction d. Wurtz fittig reaction
8. The product formed by oxidation of phenol with chromic acid is
   a. Conjugated diene b. conjugated triene
   c. conjugated diketone d. trihydric alcohol
9. The correct order of boiling points of alcohols
   a. Pentan-1-ol > Propan-1-ol > butanol
   b. butan-1-ol > butan-2-ol > pentan-1-ol
   c. Pentan-1-ol > butan-2-ol > butan-1-ol
   d. butan-1-ol > butan-2-ol > propanol

10. Iodoform test is not answered by
    a. 2-pentanone b. 3-pentanone c. Ethanal d. Ethanol
11. The PK_a Value of trifluoroacetic acid, benzoic acid, formic acid and acetic acid are 0.23, 4.19, 3.75 and 4.76 Respectively. The strongest acid amongst them is
    a. Trifluroacetic acid b. Benzoic acid c. Acetic acid d. Formic acid
12. Amides on reduction with lithium aluminium hydride yield
    a. Nitriles b. Amines c. Alcohols d. Aldehyde
13. Which of the following exists as Zwitter ion?
    a. P-nitroacetanilide b. P-nitroaniline c. Sulphanilic acid d. Salicylicacid
14. Deficiency of which vitamin increases blood clotting time
    a. Vitamin -A b. Vitamin-C c. Vitamin-E d. Vitamin-K
15. The helical structure of DNA is stabilized by
    a. Dipeptide bonds b. hydrogen bonds c. ether bonds d. peptide bonds

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

(benzenesulphonyl chloride, Unimolecular reaction, Azeotropes, tetrahedral, chloroquine)

16. Binary mixtures having the same composition in liquid and vapour phase form _____
17. The decomposition of ammonium nitrite is an example of _____
18. The structure of chromate ion is _____
19. _____ is used for the treatment of malaria.
20. Hinsberg's reagent is _____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. What is Van't Hoff factor? Mention the factors responsible for abnormal molar mass of a solute in a solution?
22. Define the term 'Collision frequency'.
23. What are ambidentate ligands? Give an example.
24. How is phenol obtained from chlorobenzene?
25. Complete the equation and Name the reaction

$$CH_3CHO \xrightarrow{Zn\text{-}(Hg)/conc.HCl} \_\_\_\_\_$$

26. Give an example of
    a. Fibrous Protein b. Globular protein

Part-C

IV. Answer any three of the following. Each question carries three marks : **3x3=9**

27. Describe the preparation of potassium dichromate from chromite ore.
28. a. What is Mischmetal? Mention its use.
    b. Write the unit of Magnetic Moment.
29. a. Give Reason:
    Cr^{3+} is a strong reducing agent whereas Mn^{3+} with the same d^4 configuration is an oxidizing agent.
    b. Which element of the first transition series shows the highest oxidation state?
30. Mention any three limitations of Valence Bond Theory.
31. a. What are Homoleptic and Heteroleptic complexes?
    b. Write the IUPAC name of the co ordination compound $[Co(NH_3)_6]Cl_3$
32. a. What is spectrochemical series?
    b. Differentiate between strong field ligands and weak field ligands

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Write any three differences between solutions showing positive and negative deviation of non- ideal solutions.
34. State Kohlrausch's Law of independent migration of ions. Mention two applications of it.
35. What is ionic conductance? How does conductivity and molar conductivity vary with concentration?
36. Derive rate equation for first order gas phase reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a. Explain Zaitsev rule with an example.
    b. What is chirality? Mention the condition for chirality.
38. a. Explain the mechanism of dehydration of ethanol to ethene.
    b. Describe Esterification reaction.
39. a. Explain Reimer Tiemann Reaction.
    b. Give reason: Phenols are more acidic than alcohols.
40. a. Write balanced chemical equation and Name the reaction.
    Benzene is treated with CO and HCl in presence of anhydrous $AlCl_3$.
    b. Describe Wolff Kishner reduction.
    c. Name the oxidizing agent used in Etard's reaction.
41. a. How is ethanoic anhydride obtained from ethanoic acid?
    b. What is the action of ammonia on acetic acid?
42. a. Describe Gabriel Phthalimide synthesis.
    b. How is 1^0-amine and 2^0-amine distinguished by using Hinsberg reagent?

43. a. Give any two differences between amylose and amylopectin.
b. What is peptide bond? How many peptide linkages are in a tripeptide?
c. Name the sugar unit present in DNA.

PART-E

VII. Answer any three of the following. Each question carries three marks: 3x3=9

44. Calculate the vapour pressure of a mixture containing 50g of liquid A(Molar mass $100gmol^{-1}$) and 75g of liquid B(Molar mass $200gmol^{-1}$).
Given Vapour pressure of liquid A is 250mm of Hg and liquid B is 150mm of Hg respectively.

45. Find the Freezing point of a solution containing 0.520g glucose [Molar mass= 180g] dissolved in 80.2g of water.
[Given K_f water= $1.86KKgmol^{-1}$]

46. Calculate the equilibrium constant for the reaction
$Cu_{(s)} + 2Ag^{+}_{(aq)} \rightleftharpoons Cu^{2+} + 2Ag_{(s)}$ [Given $E^0_{cell} = 0.46V$]

47. For the reduction reaction: MnO_4^- to Mn^{2+}
I. Write balanced Ionic equation.
II. Find the quantity of electricity in coulombs needed to reduce 1 mol of MnO_4^-
[Given F=96500C]

48. Show that for a first order reaction, the time taken for the completion of 99% of the reaction is twice the time required for completion of 90% of reaction.

49. The rate constants of a reaction at 250k and 400k are $0.01S^{-1}$ and $0.03S^{-1}$ respectively. Calculate the energy of activation of the reaction. [Given $R=8.314JK^{-1}mol^{-1}$]

Answers

I.

1. d. Molarity
2. b. 96487Cmol^{-1}
3. b. $[Zn(NH_3)_4]^{2+}$
4. b. First order reaction
5. d. both (b) and (c)
6. a. Ligands can act as Lewis acids
7. a. Finkelstein reaction
8. c. Conjugated diketone
9. d. butan-1-ol > butan-2-ol > propanol
10. b. 3-pentanone
11. a. trifluroacetic acid
12. b. Amines
13. c. Sulphanilic acid
14. d. Vitamin-K
15. b. Hydrogen bonds

II.

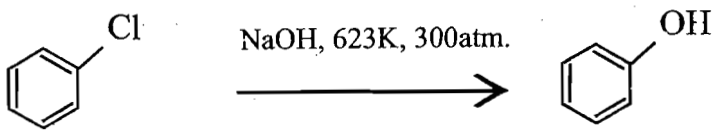
16. Azeotropes
17. Unimolecular reaction
18. Tetrahedral
19. Chloroquine
20. Benzenesulphonyl chloride.

III.

21. $$i = \frac{\text{normal molar mass}}{\text{Abnormal molar mass}} \quad \text{OR} = \frac{\text{Observed colligative property}}{\text{Calculated colligative property}}$$

$$i = \frac{\text{Total no. of moles of particles after association / dissociation}}{\text{Total no. of moles of particles before association / dissociation}}$$

22. Collision Frequency:
"The number of collisions per second per unit volume of the reaction mixture"
23. Ligands which has two different donor atoms and either of the two ligates in the complex.
Examples: NO_2^- and SCN ions.
24. By heating chlorobenzene in aqueous NaOH at 623K and at a pressure of 300atm.



25. CH_3-CH_3, Clemmensen reduction.

26. a. Fibrous protein- Keratin, Myosin b. Globular protein- Insulin, albumins

IV.

27. 3 equations of potassium dichromate manufacture.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

$$2Na_2CrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$

$$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$$

28. a. It is an alloy of lanthanoid metal (95%), 5% Iron and traces of C, Ca, S and Al.
Uses: Preparation of bullets, shell and lighter flint.
b. Bohr Magneton.

29. a. Cr^{2+} is oxidized to Cr^{3+}, its configuration changes from d^4 to d^3.
Mn^{3+} can be easily reduced to Mn^{2+} resulting in d^5 configuration.
b. Manganese.

30. It does not give quantitative interpretation of magnetic data.
It does not explain the colour exhibited by co ordination compounds.
It does not give quantitative interpretation of the thermodynamics or kinetic stabilities of Co ordination compounds.
It does not predict if co-ordination number 4 is tetrahedral or Square Planar.
It does not distinguish between weak and strong ligands.

31. a. Complexes in which the metal ion is linked to only one type of ligands
-Homoleptic complex.
Complexes in which the metal ion is linked to more than one kind of ligands
-Heteroleptic complex.
b. hexaamminecobalt (III) chloride

32. a. It is a series of arrangements of ligands in the order of increasing field strength.
b.

Strong Field Ligands	Weak Field Ligands
$\Delta_0 > P$	$\Delta_0 < P$
Form low spin complexes	Form high spin complexes

V 33.

Positive Deviated Non-Ideal solution	Negative Deviated Non-Ideal solution
Intermolecular forces decreases and the particles repel	Intermolecular forces increases and the particles attract each other.
$\Delta V_{solution} > 0$	$\Delta V_{solution} < 0$
$\Delta H_{solution} > 0$	$\Delta H_{solution} < 0$

34. " Limiting molar conductivity of an electrolyte can be represented as the sum of the individual Contributions of the anion and cation of the electrolyte"

Applications:

-To determine molar conductivity at infinite dilution for any electrolyte from limiting molar conductivity of individual ions.

-To determine the dissociation constant of weak acids.

35. The conductance of electricity by ions present in the solution is ionic conductance.

Conductivity decreases with decrease in concentration.

Molar conductivity increases with decrease in concentration.

36. In a gas phase reaction of the type

$$A_{(g)} \longrightarrow B_{(g)} + C_{(g)}$$

At t=0,	p_i	0	0
At time t,	p_i-x	x	x

Where 'x' is the decrease in pressure of reactant 'A' at time t and increase in pressure of product B & p_i is the initial pressure at time t = 0.

After a time t, total pressure $p_t = p_i - x + x + x$

$p_t = p_i + x$

$\therefore x = p_t - p_i$

But at time t, $p_A = p_i - x$

$= p_i - (p_t - p_i)$

$p_A = 2p_i - p_t$

In gas phase reactions, first order rate equation can be written by replacing concentration terms with pressures of gaseous reactions as follows:

$$K = \frac{2.303}{t} \log \frac{p_i}{p_A}$$

$$K = \frac{2.303}{t} \log \frac{p_i}{2p_i - p_t}$$

VI.

37. a. "In dehyrohalogenation reactions, the preffered product is that alkene which has the greater number of alkyl groups attached to the doubly bonded carbon atoms"

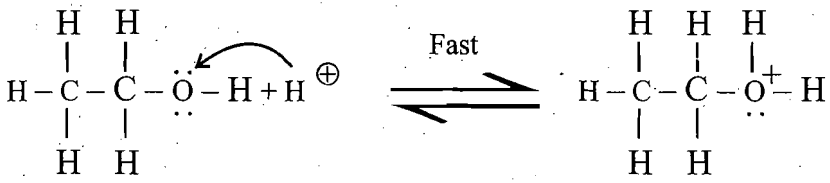
CH_3-CH_2-CH_2-CH(Br)-CH_3 → CH_3-CH_2-CH=CH-CH_3 (Pent-2-ene)Major

CH_3-CH_2-CH_2-CH=CH_2 (Pent-1-ene)Minor

b. The objects which are non superimposable on their mirror images are said to be chiral and the property is known as chirality.

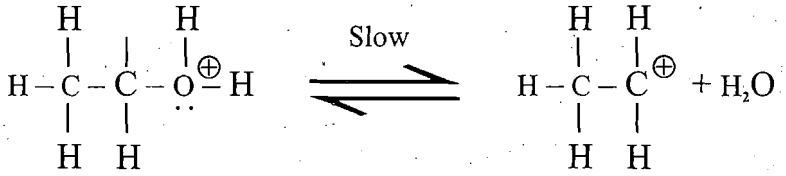
Condition:- The chiral molecule should contain asymmetric carbon atom.

38. a. Step 1 : Formation of protonated alcohol



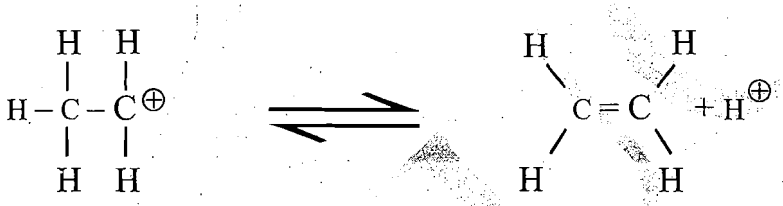
Step 2 : Formation of Carbocation : Protonated alcohol loses the water molecule to form the carbocation. It is the slowest step and hence the rate determining.

Step of the reaction.

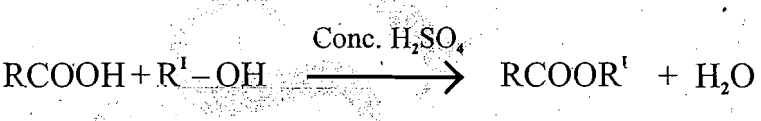


Carbocation

Step 3 : Elimination of proton : Elimination of proton from carbocation to form an alkene



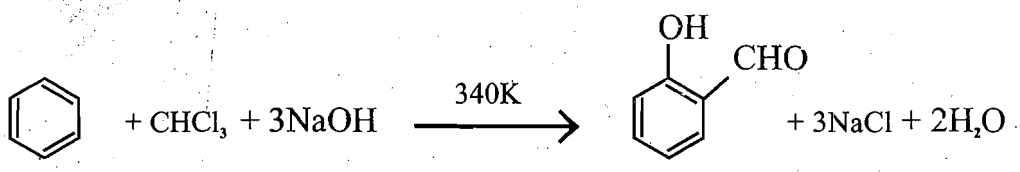
b. The reaction in which carboxylic acid reacts with alcohol in the presence of conc. Sulphuric acid to give ester.



39.

a. Reimer-Tiemann Reaction:

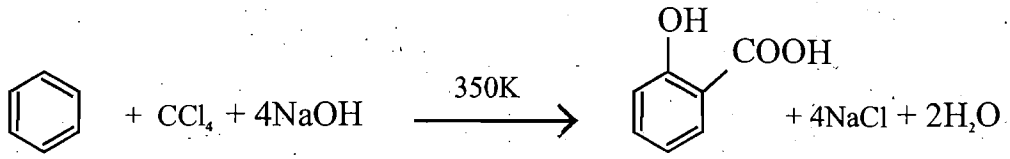
Phenol on heating with chloroform in the presence of sodium hydroxide at 340K, followed by hydrolysis gives O-hydroxy benzaldehyde (Salicylaldehyde)



Salicylaldehyde

OR

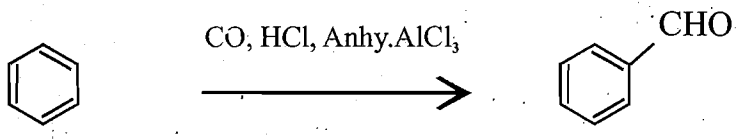
Phenol on heating with CCl_4 in presence of sodium hydroxide at 350K, followed by hydrolysis gives O-hydroxy benzoic acid (Salicylic acid)



Salicylic acid

b. In phenol, the phenoxide ion is resonance stabilized while in alcohol, alkoxide ion is not resonance stabilized.

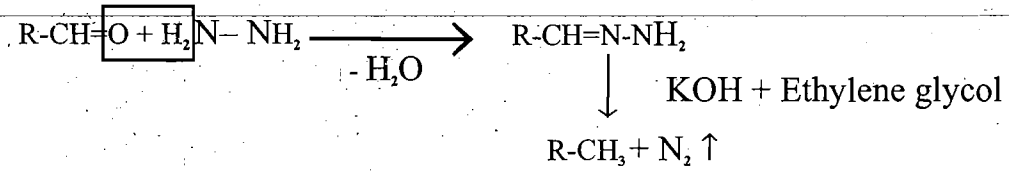
40. a.

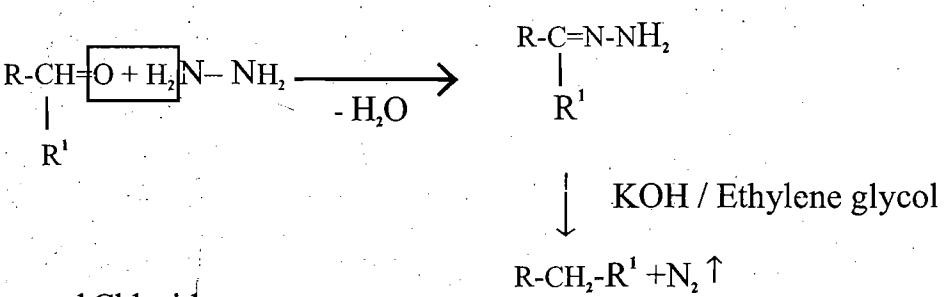


Gatterman Koch Reaction

b.

The reduction of aldehydes and ketones into corresponding hydrocarbon by heating with mixture of hydrazine and strong base like KOH in ethylene glycol is called Wolff Kishner reduction





c. Chromyl Chloride.

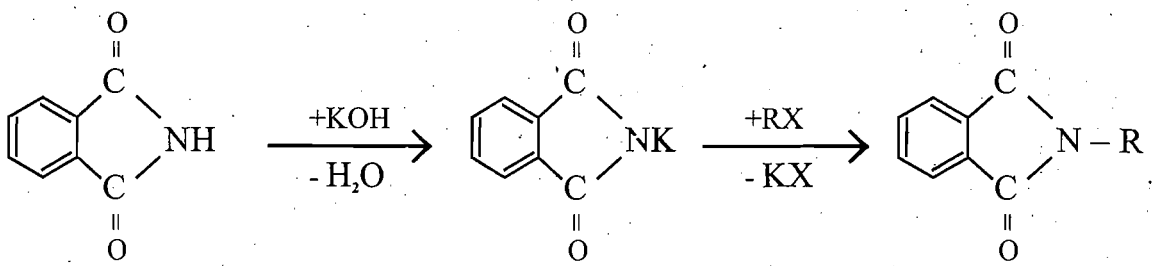
41. a. Ethanoic acid on heating with H_2SO_4 or with P_2O_5 gives corresponding ethanoic anhydride.

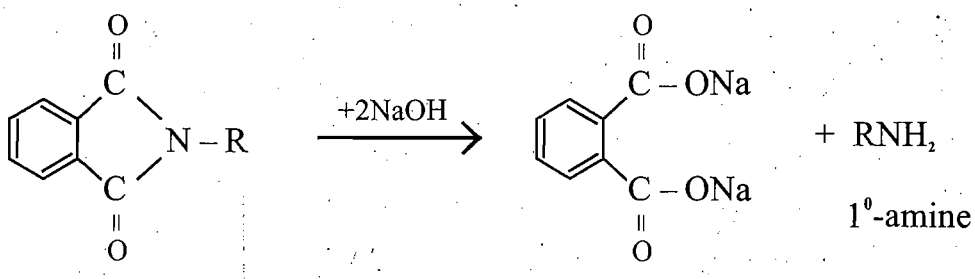
$$2CH_3COOH \xrightarrow[\Delta]{P_2O_5} (CH_3CO)_2O + H_2O$$

b. Acetic acid reacts with ammonia to form amides.

$$CH_3COOH + NH_3 \longrightarrow CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2 + H_2O$$

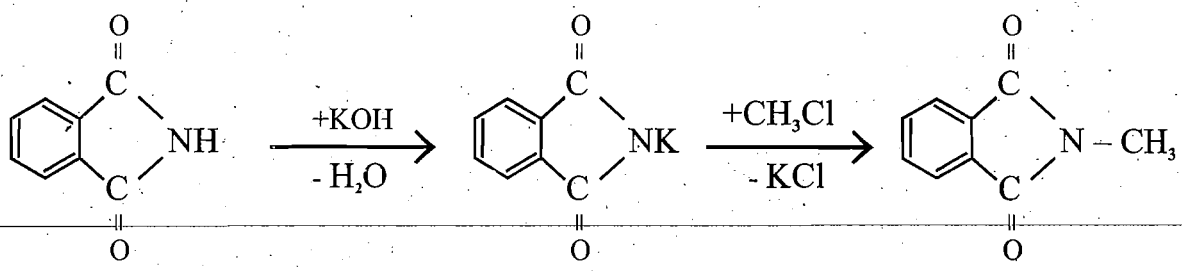
42. a. In this reaction, phthalimide reacts with KOH to form Potassium Phthalimide which on treatment with alkyl halide gives N-alkyl phthalimide which on hydrolysis with strong alkali like NaOH gives 1^0-amine.

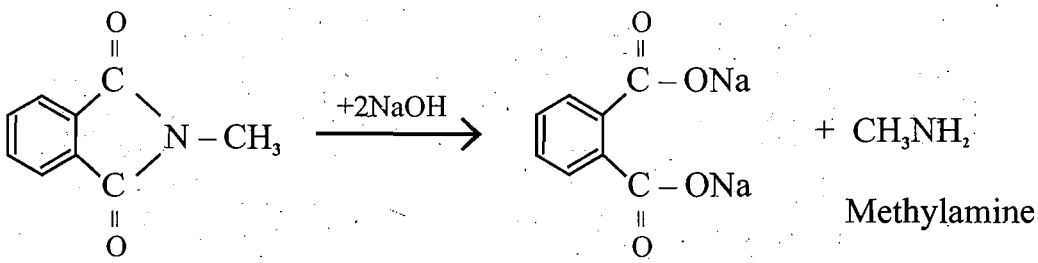




Sodium Phthalate

Ex.:





Sodium Phthalate

b. Primary amine reacts with Hinsberg reagent to give soluble salt of sulphonamide.
Secondary amine reacts with Hinsberg reagent to give insoluble salt of sulphonamide.

43.a

Amylose	Amylopectin
It is a linear polymer	It is a branched polymer
It is water soluble component of starch	It is water insoluble component of starch

b. The amide linkage (CO-NH) bond formed between two amino acids is peptide bond.
2 peptide linkages are in a tripeptide.

c. de-oxy ribose.

VII.

44. $P_A = X_A P^0{}_A$

$No.of\ moles\ of\ A = \frac{50}{100} = 0.2$

$X_A = \frac{0.2}{0.2 = 0.375} = 0.533$

$P_A = 0.533 \times 250$

$= 133.25 mmHg$

$P_{mixture} = P_A + P_B$

$= 133.25 + 70.05$

$= 203.3 mmHg$

$P_B = X_B P^0{}_B$

$No.of\ moles\ of\ B = \frac{75}{200} = 0.375$

$X_B = 1 - 0.533 = 0.467$

$P_A = 0.467 \times 150$

$= 70.05 mmHg$

45. $\Delta T_f = K_b \times \frac{Weight_{solute}}{Weight_{solvent}} \times \frac{1000}{Molecular\ mass_{solute}}$

$= 1.86 \times \frac{0.520}{80.2} \times \frac{1000}{180}$

$= 0.669K$

ΔT_f = Freezing point of Solvent - Freezing point of Solution

Freezing point of solution = 273 – 0.669

$= 272.933K$

46. $E^0{}_{cell} = \frac{0.0591}{n} \log K, \quad n = 2$

$\log K = 15.6,$

$K = anti \log(15.6)$

$K = 3.92 \times 10^{15}$

47. $5e^- + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$

Q=nF,

n=5

Q=5×96500C = 482500C

48.

$$t = \frac{2.303}{k}\log\frac{[R]_0}{[R]}$$

At 99% completition,

$$t_{99\%} = \frac{2.303}{k}\log\frac{100}{[100-99]}$$

$$= \frac{2.303}{k}\log 100$$

$$= \frac{2.303}{k}\log(10^2)$$

$$= 2 \times \frac{2.303}{k}$$

$$t_{90\%} = \frac{2.303}{k}\log\frac{100}{[100-90]}$$

$$\frac{t_{99\%}}{t_{90\%}} = 2$$

$$\therefore t_{99\%} = 2\, t_{90\%}$$

49.

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log\frac{0.03}{0.01} = \frac{E_a}{2.303 \times 8.314}\left[\frac{400-250}{400 \times 250}\right]$$

$$E_a = 6090.02 J / mol$$

****

Model Question Paper-6
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

1x15=15

I. Select the correct option from the given choices

1. Almost all processes in body occur in some kind of
   a. solid solution b. Liquid Solution c. Gaseous Solution d. Plasma Solution
2. An example of 2-1 electrolyte in the following is
   a. NaC1 b. $CaCl_2$ c. $MgSO_4$ d. $A1_2(SO_4)_3$
3. The quantity of electricity required for the reduction of one mole of $A1^{3+}$ ions is
   a. 1F b. 2F c. 3F d. 4F
4. The unit of rate of a gaseous chemical reaction is
   a. atm/s b. L/mol/s c. mol/L/s d. s^{-1}
5. The transition element which does not exhibit variable oxidation states.
   a. Cu b. V c. Mn d. Sc
6. The denticity of the EDTA (Ethylene di amine tetra acetate) ligand is
   a. 2 b. 6 c. 3 d. 1
7. The water formed during esterification reaction is removed as soon as it is formed because this reaction is
   a. reversible b. irreversible c. redox d. decomposition
8. p-nitrophenol is less volatile than o-nitrophenol due to
   a. Intramolecular H-bond b. intermolecular H-bond
   c. covalent Bond d. ionic Bond
9. The relative ease of dehydration of alcohols follows the following order:
   a. Tertiary>secondary>primary. b. secondary>tertiary>primary
   c. Primary>secondary>tertiary d. secondary>primary>tertiary
10. Fehling's solutions A is
    a. aqueous copper sulphate solution b. aqueous copper nitrate solution
    c. aqueous copper chloride solution d. aqueous copper carbonate solution

11. carboxylic acids are more acidic than phenols because.
    a. carboxylate ion is less stabilized than phenoxide ion
    b. carboxylate ion is more stabilized than phenoxide ion
    c. Phenoxide ion is more stabilized than carboxylate ion
    d. Phenoxide ion is less stabilized than carboxylate ion
12. The process of the cleavage of the C-X bond by ammonia molecule is Known as
    a. Hydrolysis b. Homolysis c. Ammonolysis d. Heterolysis
13. During diazotization, the nitrous acid is produced in the reaction mixtrure by the reaction of
    a. $NaNO_2$ & HCI b. $NaNO_3$ & HCI c. $NaNO_2$ &HNO_3 d. $NaNO_3$ & HNO_3
14. Deficiency of vitamin C cause the disease called
    a. Anaemia b. scurvy c. Rickets d. Beri Beri
15. The Nitrogenous base adenine pairs with thymine by
    a. one H-bond b. Four H-bonds c. Three H-bonds d. Two H-bonds

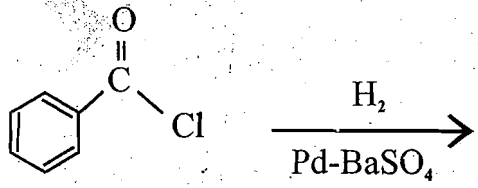
II. Fill in the blanks by choosing the appropriate word from those given in the brackets: [oxidation, edema, 6d, slowest, freons, 5d] **1x5=5**

16. The water retention in the cells of the body of the people taking a lot of salty food causing puffiness or swelling causes_____
17. The overall rate of a chemical reaction is controlled by the _____step in a reaction.
18. The transition metal series which is incomplete is ___ series.
19. The chlorofluorocarbon compounds of Methane & Ethane are called_____
20. Arylamines get coloured on storage due to atmospheric_____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. Define molal depression constant and mention its unit.
22. Define molecularity of a reaction. Give an example of unimolecular reaction.
23. What are polydentate ligands? Give an example of ambidentate ligands.
24. Explain the Swart's reaction with an example.
25. Complete the following equation and name the reaction.



26. Name the two components of starch.

Part-C

IV. Answer any three of the following. Each question carries three marks : **3x3=9**

27. Calculate the spin only magnetic moment of Fe^{2+} ion. (At. No. of Fe=26)

28. Write the balanced chemical equations involved in the manufacture of potassium dichromate($K_2Cr_2O_7$) From chromite ore.

29. Give any two reasons for the catalytic behaviour of transition metal and their compounds with one example.

30. Based on VBT, explain the geometry, hybridization & Magnetic Property of $[Co(NH_3)_6]^{3+}$

31. Give any three postulates of Werner's theory of coordination compounds..

32. What are stereo isomers? Draw the cis and trans isomers of $[Pt(NH_3)_2Cl_2]$

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Write any three differences between non-ideal solution with positive deviation and non-ideal solution with negative deviation.

34. What are fuel cells? Write the reactions occurring at anode and cathode in H_2-O_2 fuel cell.

35. What is an electronic conductance? Mention the two factors on which it depends.

36. Derive an integrated rate equation for first order reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a. Write the mechanism involved in the following reaction:

$CH_3Cl + NaOH \rightarrow CH_3OH + NaCl.$

Mention the order and configuration of the product.

b. What are optically active compounds? Give the condition for the molecule to be optically active.

38. a. Identify A, B and C in the following reaction:

$$C_6H_5Cl + A \xrightarrow[300\ atm]{623K} B \xrightarrow{C} C_6H_5OH$$

b. Name the enzymes involved in the conversion of sucrose into ethanol.

39. a. An aromatic hydrocarbon 'A' having molecular formula C_6H_6O on treating with chloroform in the presence of sodium hydroxide gives an intermediate compound 'B'. The compound 'B' is treated with alkali gives an organic compound 'C'. The compound 'C' on acid treatment yields the compound D. Write the chemical reactions and the names of A, C and D.

b. Give the IUPAC name of dimethylether

40. a. Write the chemical equation for the reaction when the two molecules of formaldehyde are heated with concentrated alkali. Name the reaction.

b. Explain Wolff-Kishner reduction with an example.

c. Formaldehyde does not undergo aldol condensation reaction. Give reason.

41. a. An acid 'X' reacts with ammonia to give 'Y' which on heating at high temperature gives benzamide. Write the chemical equation. Name the compounds 'X' and 'Y'.

b. Among benzoic acid and m-nitrobenzoic acid, which is stronger and why?

42.a. Explain acylation reaction of amines with an example. Mention the role of pyridine in this reaction.

b. Between aliphatic amines and aryl amines, which are more basic? Give reason.

43.a. What is glycosidic linkage? How many glycosidic linkages are there in one molecule of sucrose?

b. What is a protein? Though insulin contains 51 amino acids, it is considered as protein. Give reason.

c. Name the hormone responsible for preparing uterus for implantation of fertilised egg.

PART-E

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. Vapour pressure of dichloromethane (molar mass = 119.5 g/mol) and chloroform (molar mass-85 g/mol) at 298 K are 200 & 415 mm Hg respectively. Calculate the vapour pressure of the solution prepared by mixing 25.5 g of dichloromethane and 40 g of chloroform at 298 K.

45. 1 g of non-volatile solute dissolved in 50g of benzene lowered the freezing point of benzene by 0.4 K. The freezing point depression constant of benzene is 5.12 Kkg/mol. Calculate the molar mass of the solute.

46. The standard electrode potential for Daniel cell is 1.1 V. Calculate the standard Gibb's energy for the reaction: $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$. (Given, F=96487 C/mol).

47. The resistance of 0.1 M KCl solution is found to be 520 Ω and shows a conductivity value of 0.248 S/cm. Find the value of cell constant.

48. A first order reaction is found to have a rate constant, $k=5.5 \times 10^{-14}\ s^{-1}$. Find the half-life of the reaction.

49. The rate constants of a reaction at 500 K and 700 K are $0.02\ s^{-1}$ and $0.07\ s^{-1}$ respectively. Calculate the value of E_a (Energy of activation).

Answers

I.

1. b)liquid solutions
2. b) $CaCl_2$
3. c) 3F
4. a) atm/s
5. d) Sc
6. b) 6
7. a) reversible
8. b) intermolecular H-bond
9. a) Tertiary >Secondary > Primary
10. a) aqueous copper sulphate solution
11. b) carboxylate ion is more stabilised than phenoxide ion
12. c) Ammonolysis
13. a) $NaNO_2$ & HCl
14. b) Scurvy
15. d) Two H-bonds

II.

16. edema
17. slowest
18. 6d
19. freons
20. oxidation

III.

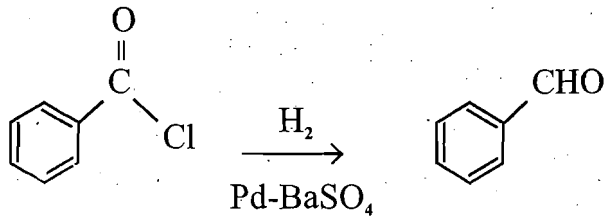
21. Molal depression constant is the decrease in the freezing point of the solvent in one molal solution.Its unit is Kkg/mol.
22. Molecularity of a reaction is the number reacting species taking part in an elementary reaction, which must collide simultaneously in order to bring about a chemical reaction. Decomposition of ammonium nitrite is an example of unimolecular reaction i.e., $NH_4NO_2 \rightarrow N_2 + 2H_2O$
23. Polydentate ligands are the ligands with several donor atoms in a single ligand. NO_2^- or SCN^- is an example of ambidentate ligand
24. The alkyl fluorides are synthesized by heating an alkyl chloride/bromide in the presence of a metallic fluoride such as AgF. Hg_2F_2, CoF_2 or SbF_3. The reaction is termed as Swarts reaction.

$$R\text{-}X + AgF \longrightarrow R\text{-}F + AgX$$

X=Cl, Br

$$H_3C\text{-}Br + AgF \longrightarrow H_3C\text{-}F + AgBr$$

25.



Benzoyl Chloride Benzaldehyde

This reaction is called Rosenmund's reduction

26. Amylose and amylopectin.

IV.

27. Iron (atomic number 26) in +2 oxidation state has d^6 configuration and hence there are 4 unpaired electrons i.e, n= 4.
Spin only magnetic moment,

$$\mu = \sqrt{n(n+2)} = \sqrt{4(4+2)} = \sqrt{4\times 6} = 4.90\ BM$$

28.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

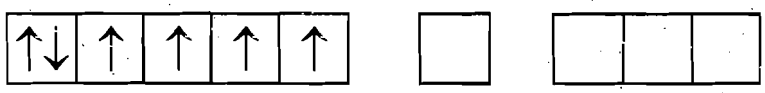
$$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

29. Transition metals and their compounds show catalytic properties due to their ability
i) to adopt multiple oxidation states
ii) to form complexes.
Ex: Vanadium (V) oxide in Contact Process or finely divided iron in Haber's Process or nickel in Catalytic Hydrogenation.

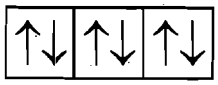
30. $[Co(NH_3)_6]^{3+}$: oxidation state of cobalt ion is +3 & electronic configuration $3d^6$.
Geometry of complex: octahedral.
Magnetic property: diamagnetic because of the absence of unpaired electron.
This complex is called an inner orbital or low spin or spin paired complex because inner d orbital (3d) is used in hybridisation in the formation of this complex,
$[Co(NH_3)_6]^{3+}$: Type of Hybridisation is d^2sp^3

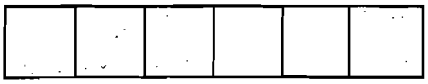
Orbitals of Co^{3+} ion



3d 4s 4p

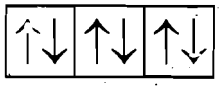
d^2sp^3 hybridised orbitals is of Co^{3+}

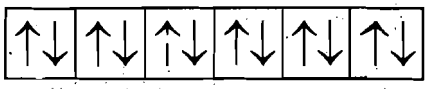




d^2sp^3 hybrid orbitals

$[Co(NH_3)_6]^{3+}$ (inner orbital or low spin complex)

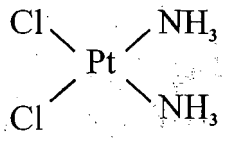




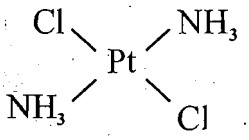
Six pairs of electrons from six NH_3 molecules

31. The main postulates of Werner's theory of coordination compounsts
- In coordination compounds, metals show two types of linkages (valences) primary & secondary.
- The primary valences are ionisable & are satisfied by negative ions. • The secondary valences are non-ionisable satisfied by neutral molecules or negative ions.
- The secondary valence is equal to the coordination number & is fixed for a metal.
- Ions/groups bound by secondary linkages to the metal have characteristic spatial arrangements & are called coordination polyhedra.
- The species within the square bracket are coordination entities orcomplexes & the ions outside the square bracket are called counter ions. (any three).

32. Stereoisomers have the same chemical formula & chemical bonds but they have different spatial arrangement.



cis



trans

Geometrical isomers cis and trans of $[Pt(NH_3)_2Cl_2]$

V

33.

Property	Non-Ideal Solution with +ve deviation	Non-Ideal Solution with -ve deviation
Enthalpy of mixing ($\Delta_{mix}H$)	Positive	Negative
Volume of mixing ($\Delta_{mix}V$)	Positive	Negative
Inter molecular forces	A-B forces are weaker than A-A & B-B forces	A-B forces are stronger than A-A & B-B forces

34. Fuel cells are the galvanic cells which convert the energy of combustion of fuels like H_2, CH_4, CH_3OH etc., directly into electrical energy.

Cathode: $O_2(g)+2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$

Anode: $2H_2(g)+4OH^- \rightarrow 4H_2O(l) + 4e^-$

35. Electrical conductance through metals is called metallic or electronic conductance. It depends on nature and structure of the metal, number of valence electrons per atom, temperature. (any two factors)

36. First Order Reaction has the rate of the reaction is proportional to 1st power of the concentration of reactants. Consider the reaction, R→P

Rate=$-d[R]/dt = k[R]^1 = k \times [R]$

$d[R]/[R] = -kdt$ (integrating both sides)

$\ln [R] = -kt + I$ (where, I = integration constant) ---------- (1)

$\ln [R]_0 = -k \times 0 + I$ (∵at t=0, $[R]=[R]_0$=initial concentration of the reactant)

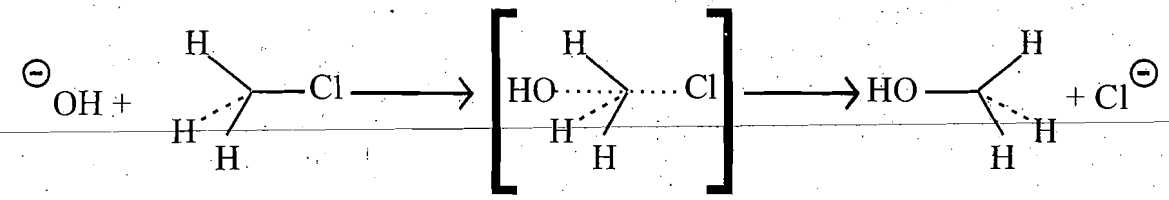
$\ln [R]_0 = I$

From equation (1), $\ln [R] = -kt + \ln [R]_0$ (because $I = [R]_0$)

Therefore, rate constant, $k = \frac{1}{t}\ln\frac{[R]_0}{[R]} = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$

VI.

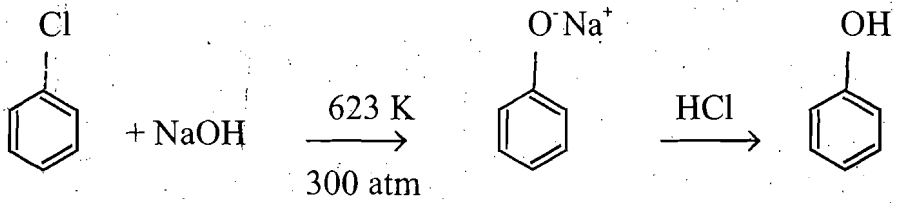
37. a)



It follows a second order kinetics, ie, the rate depends upon the concentration of both the reactants. The product has an inversion of configuration.

b) Compounds which rotate the plane polarised light are called optically active compounds. The molecule should contain an asymmetric or stereo center to be optically active.

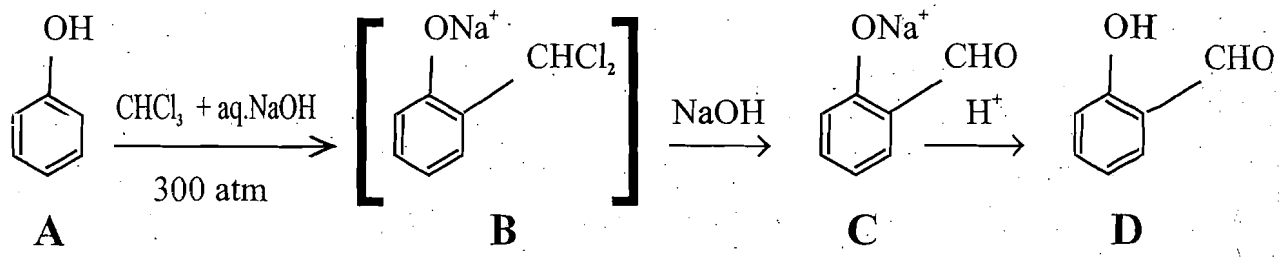
38. a.



A=NaOH B=$C_6H_5O^-Na^+$ C=HCl

b. Invertase and zymase

39. a.

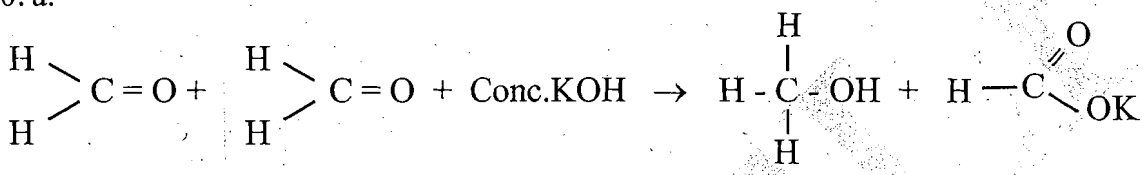


A **B** **C** **D**

A = Phenol C = sodium salt of salicylaldehyde D = salicylaldehyde

b. Methoxymethane

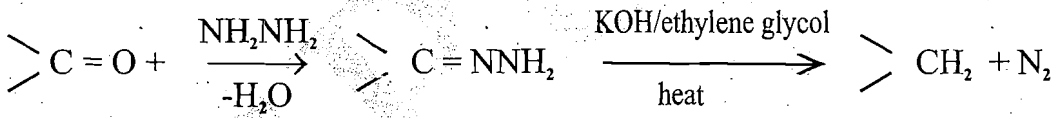
40. a.



Formaldehyde Methanol Potassium Formate

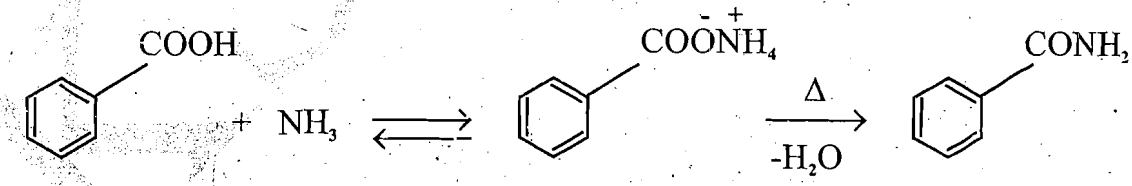
Cannizzaro reaction

b. Carbonyl group of aldehydes & ketones is reduced to CH_2 group on treatment with hydrazine followed by heating with sodium or potassium hydroxide in high boiling solvent such as ethylene glycol.



c. Due to absence of α-hydrogen atoms

41. a.



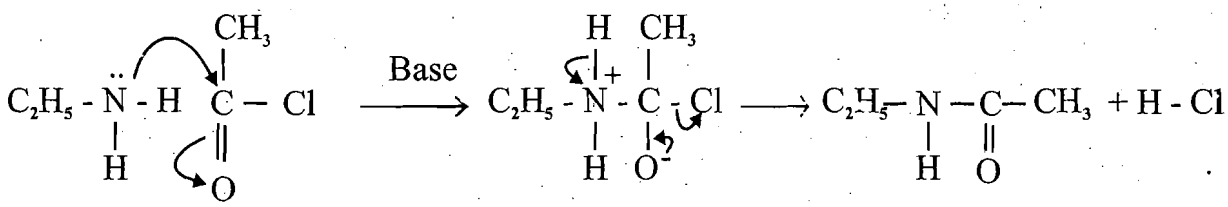
Ammonium Benzoate Benzamide

X-Benzoic acid Y-Ammonium benzoate

b. m-nitrobenzoic acid is stronger than benzoic acid.

Because the presence of electron withdrawing groups like nitro group increase the acidity of carboxylic acids by stabilising the conjugate base through delocalisation of the negative charge by inductive and/or resonance effects.

42. a. Aliphatic & aromatic primary & secondary amines react with acid chlorides, anhydrides & esters by nucleophilic substitution reaction. This reaction is known as acylation.



Ethanamine N-Ethylethanamide

This reaction is carried out in the presence of a base stronger than the amine, like pyridine, which removes HCl so formed and shifts the equilibrium to the right hand side.

b. Aliphatic amines are stronger bases than arylamines due to presence of +I (positive inductive) group i.e., alkyl group.

43. a. The two monosaccharides are joined together by an oxide linkage formed by the loss of a water molecule. Such a linkage between two monosaccharide units through oxygen atom is called glycosidic linkage.
There is one glycosidic linkage in one sucrose molecule.

b. Protein is a polypeptide with more than hundred amino acids having molecular mass higher than10,000u.
Though insulin contains fewer (51) amino acids, it is considered as protein because it has got well- defined conformation of a protein.

c. progesteron

VII 44. Moles of $CHCl_3 = \frac{25.5g}{119.5gmol^{-1}} = 0.213mol$

Moles of $CH_2Cl_2 = \frac{40g}{85gmol^{-1}} = 0.47mol$

Total number of moles = 0.213 + 0.47 = 0.683 mol

$X_1(CHCl_3) = \frac{0.213}{0.683} = 0.312$

$X_2(CH_2Cl_3) = 1 - X_1 = 1 - 0.312 = 0.688$

$\therefore p_{total} = p_1^0 X_1 + p_2^0 X_2$

$But\ X_1 = 1 - X_2$

$= p_1^0 - (p_2^0 - p_1^0)X_2$

$= 200 + (415 - 200) \times 0.688$

$= 200 + 147.9 = 347.9mmHg$

45.

$$M_2 = \frac{K_f \times w_2 \times 1000}{\Delta T_f \times w_1}$$

$$= \frac{5.12 KKg/mol \times 1.00g \times 1000g/kg}{0.40K \times 50g_1}$$

$$= 256 g/mol$$

Molar mass of the solute = 256 g/mol

46. Given, n=2, F=96487 C/mol and $E^0_{cell} = 1.1\ V$

$$\Delta G^0 = -nF\, E^0_{cell}$$

$$= -2 \times 1.1V \times 96487\ C/mol$$

$$= -212227\ J/mol$$

$$= -212.27\ kJ/mol$$

47. G*(Cell constant) = R (Resistance) × k (Conductivity)

$= 520\Omega$ x 0.248 S/cm

$= 128.96\ cm^{-1}$

48. Half-life period for a first order reaction is

$$t_{1/2} = \frac{0.693}{K}$$

$$= \frac{0.693}{5.5 \times 10^{-14} s^{-1}}$$

$$= 1.26 \times 10^{13} s$$

49. $$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log \frac{0.07}{0.02} = \left(\frac{E_a}{2.303 \times 8.314 JK^{-1}mol^{-1}}\right)\left[\frac{700-500}{700 \times 500}\right]$$

$$0.544 = E_a \times 5.714 \times 10^{-4} / 19.15$$

$$E_a = 0.544 \times 19.15 / 5.714 \times 10^{-4} = 18230.8\ J = 18.2308 KJ$$

****

Model Question Paper-7
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

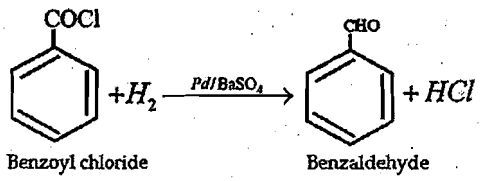
1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part- A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A **1x15=15**

I. Select the correct option from the given choices

1. The unit of molarity is
   a. mol / L b. mol / Kg c. $mol^{-1}L^{-1}$ d. mol L
2. Which of the following is the example for inert electrode?
   a. Gold electrode b. Copper electrode
   c. Zinc electrode d. Silver electrode
3. On charging the lead storage battery, $PbSO_4$ on cathode is converted into
   a. PbO_2 b. Pb c. PbO d. No change
4. In the equation $K = Ae^{-Ea/RT}$, Ea stands for
   a. Threshold energy b. Collision frequency
   c. Arrhenius factor d. Activation energy
5. Which of the following shows maximum number of oxidation state ?
   a. Cr b. Fe c. Mn d. V
6. The number of unpaired electrons in the complex $[CoF_6]^{3-}$ ion is
   a. 2 b. 3 c. 4 d. zero
7. Which of the following has the highest melting point?
   a. O-dichlorobenzene b. M-dichlorobenzene
   c. P-dichlorobenzene d. Chlorobenzene
8. In kolbe's reaction the reacting substances are
   a. C_6H_5ONa and CCl_4 b. C_6H_5OH and $CHCl_3$
   c. C_6H_5ONa and CO_2 d. C_5H_5OH and CCl_4
9. The alcohol that produces turbidity immediately with Lucas reagent at room temperature is
   a. Butan-1-ol b. Butan-2-ol
   c. 2-Methyl propan-2-ol d. 2-Methyl propan-1-ol

10. Name of the reaction is



a. Etards reaction b. Rosenmund reduction
c. Gatterman-Koch reaction d. Stephen reduction

11. Which of the following is more acidic?
a. CH_3COOH b. $ClCH_2COOH$
c. $BrCH_2COOH$ d. FCH_2COOH

12. Gabriel phthalimide synthesis is used for the preparation of
a. Primary aromatic amines b. Primary aliphatic amines
c. Secondary amines d. Tertiary amines

13. The correct order of the basic strength of amines in aqueous solution is
a. $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$ b. $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$
c. $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$ d. $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

14. Which one of the following acids is a Vitamin ?
a. Aspartic acid b. Ascorbic acid c. Adipic acid d. Saccharic acid

15. In DNA, complementary bases are
a. A=T and G ≡ C b. A=T and G ≡ U
c. A=G and T ≡ U d. T=G and A ≡ U

II. Fill in the blanks by choosing the appropriate word from those given in the brackets:
[Diamagnetic, Azeotropes, Pseudo-first order, Paramagnetic, Pyramidal, 2-Chloro-2-methyl propane] **1x5=5**

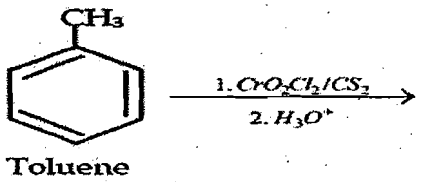
16. A liquid mixture which boiis at constant temperature without undergoing any change in the composition is called _____
17. Inversion of cane sugar and acid hydrolysis of acetate are examples of _____ reaction.
18. Cu^{+2} is paramagnetic while Zn^{+2} is _____.
19. IUPAC name of tertiary butyl chloride is _____
20. The geometry of amines is _____

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. State Raoults law of relative lowering of vapour pressure. Write its mathematical form.
22. Draw a graph of potential energy versus reaction coordinate to show the effect of catalyst on activation energy?
23. What are Homoleptic complexes? Give an example
24. Name the organic product formed when chloroalkane is heated with sodium iodide (NaI) in dry acetone.
    i. Write the chemical equation for the above reaction.
    ii. Name the above reaction.

25. Complete the equation and name the reaction.



Toluene

26. Name two hormones used to treatment of Addison's disease.

Part-C

IV. Answer any three of the following. Each question carries three marks : 3x3=9

27. a. Give reason transition metals and their many compounds act as good catalysts.
    b. Between Sc^{3+} and Cu^{2+} ions, which is colourless?
28. Explain the preparation of potassium permanganate from pyrolusite ore (MnO_2) with equations.
29. Write any three differences between lanthanoids and actinoids.
30. a) Write the IUPAC name of $[Cr(NH_3)_3(H_2O)_3]Cl_3$?
    b) Give the facial (fac) and meridional (mer) isomeric structures of $[Co(NH_3)_3(NO_2)_3]$.
31. According to VBT, explain hybridization, geometry and magnetic property of $[Co(NH_3)_6]^{3+}$ ion.
32. Write the postulates of Werner's theory of co-ordination compounds.

V. Answer any two of the following. Each question carries three marks: 2x3=6

33. Define Azeotropes. What type of azeotrope is formed by positive deviation from Raoult's? Give an example.
34. Define molar conductivity, How is it related to concentration & conductivity? Write the SI unit of conductivity.
35. Explain hydrogen-oxygen fuel cell with neat labelled diagram.
36. Derive an integrated rate equation for the rate constant of a first order reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: 4x5=20

37.a) An organic compound 'A' with the molecular formula (+) C_4H_9Br under goes hydrolysis to form (±) C_4H_9OH. Give the structure of 'A' and write the mechanism of the reaction. **(3+2)**

b) Explain fittig reaction with an equation.

38.a) What is lucas reagent? How would you distinguish primary, secondary and Tertiary alcohols by using lucas reagent **(3 + 2)**

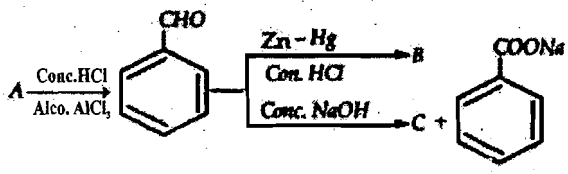
b) Explain williamson's ether synthesis with an example.

39.a) How would you prepare phenol from cumene? Give equation. **(2 + 2 + 1)**

b) Explain kolbe's reaction with equation.

c) Write the chemical name (IUPAC name) of picric acid.

40. a) Identify A, B and C in the following reaction. **(3 + 2)**



b) What is esterification reaction? Give an example.

41.a) Explain the preparation of carboxylic acid using Grignard reagent. **(2 + 2 + 1)**

b) Explain conversion of benzoic acid to benzamide with equation.

c)The Pka value of 4-methoxy benzoic acid is greater than 4-nitrobenzoic acid. Which among them is stronger acid.

42.a) Explain Hoffmann bromamide reaction with example. **(2 + 2 + 1)**

b) How do you prepare benzene diazonium chloride by diazotization? Give equation.

c) Give reason; aromatic amines are weaker bases than ammonia.

43.a) Write the Haworth structure of Sucrose. **(2 + 2 + 1)**

b) what is Fibrous protein? Give an example.

c) Name the disease caused by the deficiency of Vitamin-D.

PART-E (Problems)

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. The vapour pressure of ethanol and methanol are 44.5mm and 88.7 mm of Hg respectively. A solution is prepared by mixing 60g of ethanol and 40g of methanol. Assuming the solution to be ideal, calculate the vapour pressure of the solution.

45. The boiling point of benzene is 353.23K. When 1.8g of non-volatile solute was dissolved in 90g of benzene, the boiling point is raised to 354.11K. Calculate the molar mass of the solute. K_b for benzene is 2.53Kkg/mol.

46. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of nickel is deposited at the cathode? [molar mass of Ni = 58.7 gram/mol].

47. Calculate the EMF of the cell for the reaction. $Mg + 2Ag^+ \rightarrow Mg^{2+} + 2Ag$

[Given: $E^0_{Mg^{2+}/Mg} = -2.37V$, $E^0_{Ag^+/Ag} = 0.80V$,

$[Mg^{2+}] = 0.001M$, $[Ag^+] = 0.0001M$ and $\log 10^5 = 5$]

48. A reaction is first order in A and second order in B.

i. write the differential rate equation.

ii. How is the rate of the reaction affected when Concentration of B alone is increased to three times?

iii. How is the rate of the reaction affected when The concentration of A as well as B is doubled?

49. The rate constants of a reaction at 300K and 400K are $0.034\ s^{-1}$ and $0.136\ s^{-1}$ respectively. Calculate the value of a E_a ($R=8.314 JK^{-1}mol^{-1}$).

Answers

I.

1. a)mol/L
2. a) Gold Elect rode
3. a) PbO_2
4. d) Activation Energy
5. c) Mn
6. c) 4
7. c) P-di Chlore Benzene
8. c) C_6H_5ONa and CO_2
9. c) 2- Methylpropan-2-ol
10. b) Rosenmund Reduction
11. d) FCH_2COOH
12. b) Primary aliphatic amines
13. b) $(CH_3)_2$ NH > CH_3NH_2 > $(CH_3)_3N$.
14. b) Ascorbic acid
15. a) A=T and G=C

II.

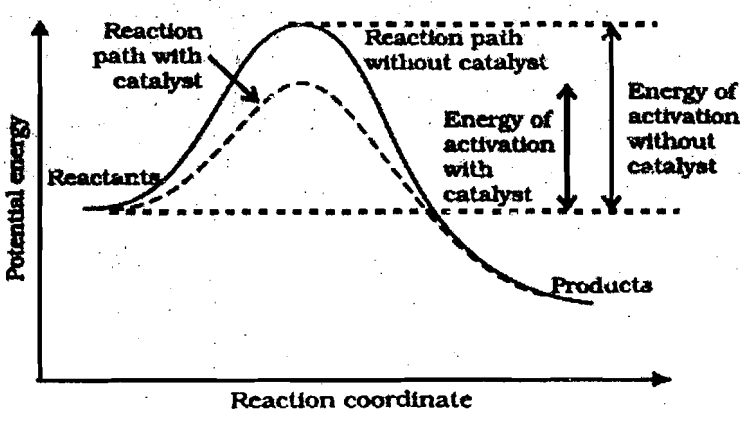
16. Azeotropes
17. Pseudo-Firstorder
18. Diamagnetic
19. 2-Chloro-2-Methyl Propane
20. Pyramidal

III.

21. In a Solution Containing non-Volatile solute, the relative lowering of vapour pressure is equal to the mole fraction of the solute in dilute solution.

$$\frac{P_A^0 - P_A}{P_A^0} = \frac{n_B}{n_A + n_B} = X_B$$

22.



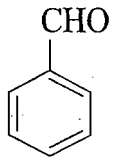
23. The Complexes in which only one kind of ligands coordinated with metal in the complex.

Ex: $[Fe(CO)_5]$ or $[Ni(CO)_4]$

Or $K_4[Fe(CN)_6]$

24. $RCl + NaI \xrightarrow{\text{Dry acetone}} RI + Nacl$

Finkelstein Reaction

25. 

Etard's Reaction

26. Gluco corticoids and Mineralocorticoids

IV.

27. a) The Transition Elements and their compounds behaves as catalysts due to

i) Variable Oxidation States

ii) Large surface area for adsorption of reactant molecules.

iii) The presence of incompletely filled or partially filled d-orbitals

b) Sc^{+3} due to absence of unpaired electrons.

28. **Step 1:** Pyrolusite is powdered and fused with KOH in presence of KNO_3 as on oxidising agent to form Potassium manganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

Step 2: The Potassium Manganate under goes disproportionation in acidic or Neutral medium to give permanganate.

$$3MnO_4^{-2} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

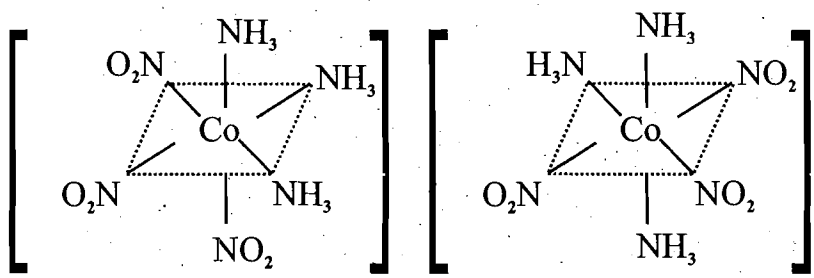
The purple solution so obtained is concentrated to get dark purple crystals of $KMnO_4$.

29.

Lanthanoids	Actinoids
1) Electrons enters into 4f - orbitals	Electrons enters into 5f – orbitals
2) They are non-radioactive except Pm.	All are radioactive.
3) Lanthanoid contraction is lesser	Actinoid Contraction is greater
4) Binding energies of 4f- electrons are higher	Binding energies of 5f - electrons are lesser.

30. a) Triammine triaqua Chromium (III) Chloride

b)



fac- mer-

31. In $[CO(NH_3)_6]^{+3}$, The cobalt is in +3 oxidation state and has the electronic configuration : $[Ar]\,3d^6 4s^0$

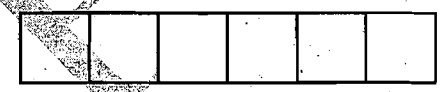
Valence Orbitals: CO^{3+}

3d 4s 4p

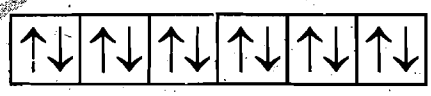
When strong ligand, NH_3 is approaching towards centra metalion, rearrangement of electrons takes places against the Hund's rule.

3d 4s 4p

d^2sp^3 hybridisation results Co-hybrid orbitals pointing towards six corners of an octahedron.



These six hybridised orbitals of Co^{+3} overlaps with orbitals of six ammonia ligands and six pairs of electrons donated by six ammonia ligands to form six coordinate bonds.



Six d^2sp^3 hybrid orbitals with six pairs of electrons of NH_3 ligands.

The Complex has octahedral geometry and is diamagnetic because of the absence of unpaired electrons. Since the inner d-orbital (3d) is used in hybridisation. The Complex $[CO(NH_3)_6]^{+3}$ is called inner orbital complex or low spin complex or spin paired complex.

32. In Co ordination compound metal exhibit 2-type of valence 1^0- & 2^0-Valency.

1^0 – Valencies are ionisable and represents, the oxidation state of a metal.

2^0 – Valencies are non-ionisable and represents co-ordination number.

1^0 – Valencies are satisfied by anions.

2^0 – Valencies are satisfied by both neutral and anions on molecules called ligands

1^0 – Valencies are not fixed

2^0 – Valency is fixed as the coordination number is fixed

1^0 – Valency is non- directional

2^0 – Valency is directional in space which leads to definite geometry to the complex.

V.

33. Binary liquid mixtures having the same composition in liquid and vapour phase and boil at a constant temperature are called azeotropic mixture. Azeotrope is formed by positive deviation from Raoult's law is minimum boiling point azeotrope.
Ex: Mixture of Ethanol and Acetone.

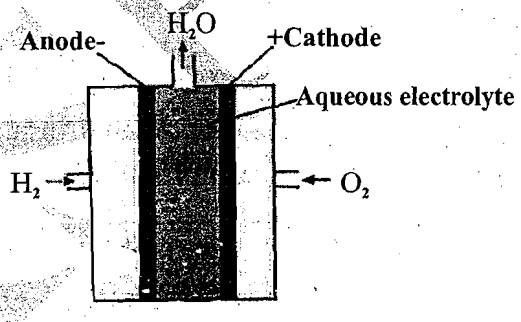
34. It is the conductance of all the ions produced in the entire solution which contains one mole of an electrolyte. It is denoted by Λ_m and related to concentration and conductivity by the equation.

$$\Lambda_m = \frac{K}{C}$$

OR $\Lambda_m = K.V$ where $C = \frac{1}{V}$

SI Unit : $Sm^2\ mol^{-1}$

35. In H_2- O_2 fuel cell electrical energy produced by the combustion of H_2 as a fuel.



The electrode reactions are as shown below:

At anode: $2H_2(g) + 4OH^-(aq) \rightarrow 4H_2O(l) + 4e^-$

At Cathode : $O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH(aq)$

The overall cell reaction is $2H_2 + O_2(g) \rightarrow 2H_2O(l)$

The cell runs continuously as long as the reactants are supplied.

36. Consider a first order reaction

$R \rightarrow P$.

A First order reaction is one in which the rate is directly proportional to first power of the reactant concentration. Therefore, according to rate law

$$\text{Rate } \alpha \quad [R]^1$$

$$\text{Rate} = K[R]^3 \text{ ----------(1)}$$

Where K is rate constant or Velocity Constant

$$\text{But Rate} = \frac{-d[R]}{dt}$$

$$\frac{-d[R]}{dt} = K[R] \text{ ----------(2)}$$

Rearrange the equation (2), we get

$$\frac{-d[R]}{[R]} = -Kdt \text{ ----------(3)}$$

Integrate equation (3)

$$\int \frac{1}{[R]} d[R] = -K \int dt$$

$$\ln[R] = -Kt + I \text{ ----------(4)}$$

When t=0, $[R] = [R]_0$. Where $[R]_0$ is the concentration of reactant R

$$\ln[R]_0 = -K(0) + I$$

$I = \ln [R]_0$ Where I is called integration constant

Substituting the value of I in equation (4). We get

$$\ln[R] = -Kt + \ln[R]_0$$

$$Kt = \ln[R]_0 - \ln[R]$$

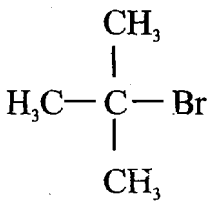
$$Kt = \ln \frac{[R]_0}{[R]}$$

$$Kt = 2.303 \log \frac{[R]_0}{[R]}$$

$$K = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

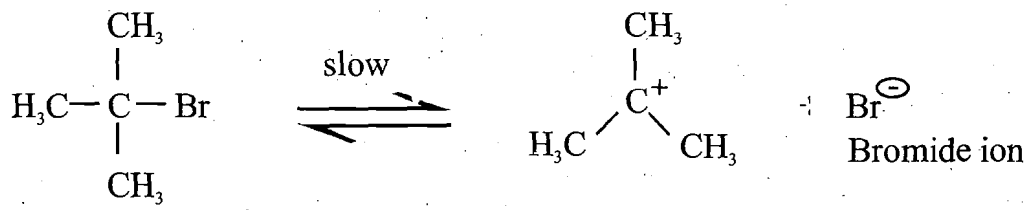
VI.

37. Structure of A



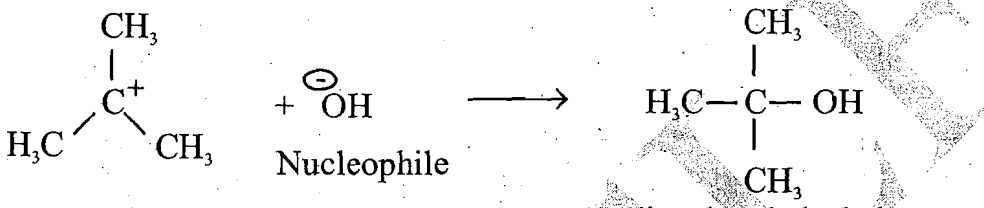
Mechanism of Hydrolysis

Step I:



tertiary butyl bromide — tertiary butyl carbocation

Step 2:



tertiary butyl alcohol

b) It is a characteristic reaction of Aryl halide, when two molecules of aryl halides react with sodium metal in dry ether to give Diphenyl

Diphenyl

38. a) Mixture of anhydrons $ZnCl_2$ and ConC. HCl is called Lucas reagent

1^0- alcohol + Lucas Reagent	Turbidity will not be observed at room temperature
2^0- alcohol + Lucas Reagent	Turbidity appears after 5 minutes
3^0- alcohol + Lucas Reagent	Turbidity appears immediately

b) It is a reaction of converting

Alkyl halide in to ether by treating with sod or pot alkoxide

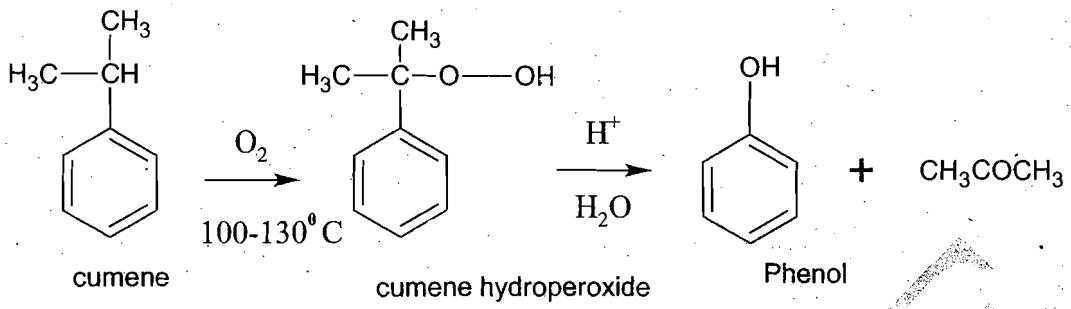
$$R\text{-}X + R^1ONa \longrightarrow R\text{-}O\text{-}R^1 + NaX$$

Ether

$$Ex: CH_3I + CH_3ONa \longrightarrow CH_3\text{-}O\text{-}CH_3 + NaI$$

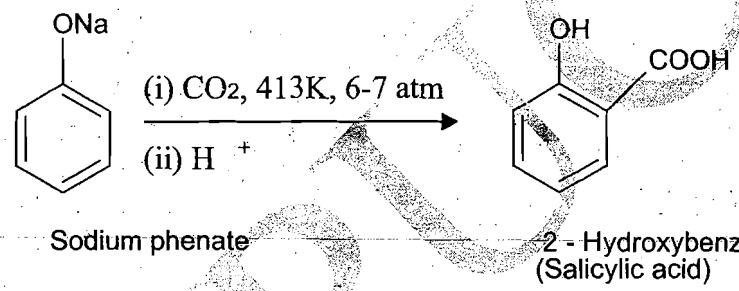
Methoxy methane

39. a) On heating cumene with air on O_2 gives cumene hydro peroxide which on acid hydrolysis gives phenol & acetone



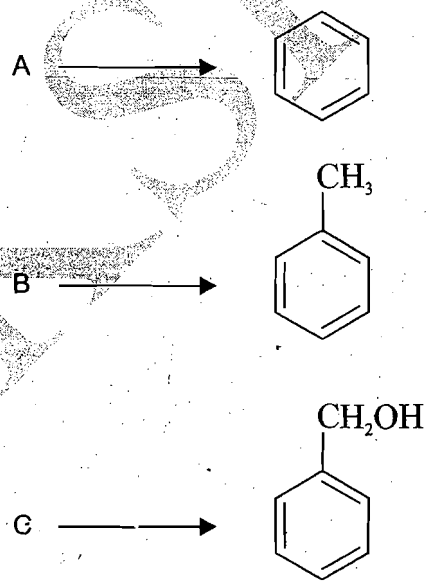
cumene — cumene hydroperoxide — Phenol

b) Sodium Phenate on heating with CO_2 at 413K & 6-7 at m Pressure gives sodium salicylate which on acidification gives salicylic acid. This reaction is called Kolbe's Reaction.



Sodium phenate — 2 - Hydroxybenzoic acid (Salicylic acid)

40. a)



b) It is a reaction between an alcohol & a carboxylic acid in presence of Conc. H_2SO_4 or dry Hcl giving pleasent smelling ester.

$$RCOOH + R^1OH \xrightarrow{Conc.H_2SO_4} R\text{-}COOR^1 + H_2O$$

$$Ex: CH_3COOH + CH_3OH \xrightarrow[-H_2O]{Conc.H_2SO_4} CH_3COOCH_3$$

Ethanoic acid Methanol Methyl Ethanoate

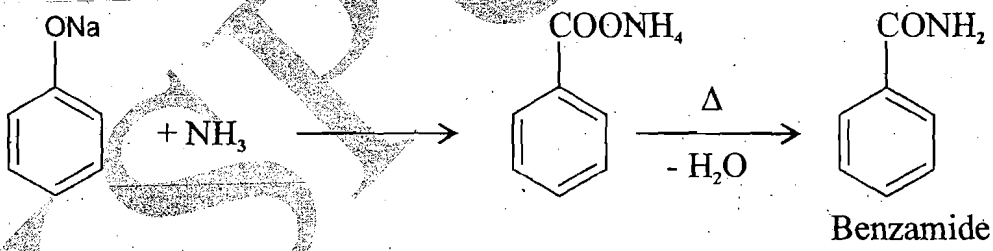
41. a) Grignard reagents react with solid CO_2 (dry ice) to form salts of carboxylic acids which on acid hydrolysis gives carboxylic acids.

$$R\text{-}MgX + C(=O)=O \longrightarrow \left[R\text{-}C(OMgX)=O\right] \xrightarrow{H_3O^{\oplus}} RCOOH + Mg(OH)X$$

$$Ex: CH_3\text{-}MgBr + C(=O)=O \longrightarrow \left[CH_3\text{-}C(OMgBr)=O\right] \xrightarrow{H_3O^{\oplus}} CH_3COOH + Mg(OH)Br$$

Ethanoic acid

b) Benzoic acid on reaction with NH_3 gives Ammonium benzoate which on heating gives benzamide



Benzamide

c) 4-nitrobenzoic acid

42. a) Amides on heating with Br_2 and aq. Alkali gives 1^0- amines. This reaction is called Hoffman's bromamide reaction.

$$R\text{-}CO\text{-}NH_2 + Br_2 + 4NaOH_{(aq)} \longrightarrow R\text{-}NH_2 + 2NaBr + 4Na_2CO_3 + 2H_2O$$

Amide 1^0- amine

$$Ex: R\text{-}CO\text{-}NH_2 + Br_2 + 4NaOH_{(aq)} \longrightarrow R\text{-}NH_2 + 4Na_2CO_3 + 2H_2O$$

Acetamide Methanamine

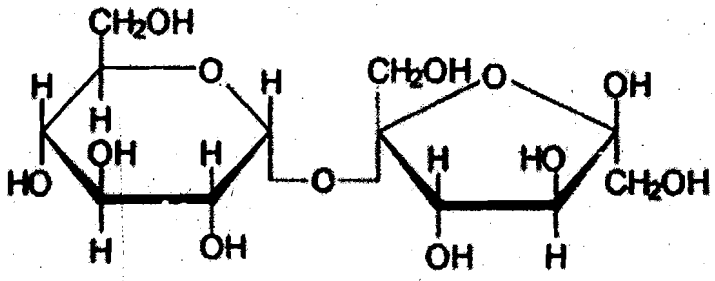
b) Benzene diazonium Chloride can be obtained by treating aniline in an ice cold. Solution of sodium nitrite in dil. HCl

$$C_6H_5NH_2 \xrightarrow[0\text{-}5^0C]{NaNO_2 + HCl} C_6H_5\text{-}N{=}N\text{-}Cl + H_2O$$

Aniline — Benzenediazonium chloride

c) Due to electron with drawing nature of benzene ring.

43. a) Haworth ring structure of sucrose



1, 2- glycosidic bond

b) The proteins have woven thread like structure are called Fibrous Proteins.
Ex: Keratin present in hair, silk, collagen present in cartilage.

c) Rickets or Osteomalacia.

VII.

44. Mol. Mass of Ethanol = $C_2H_5OH = 46\ gmol^{-1}$

No. Of moles of Ethanol = $\frac{60g}{46gmol^{-1}} = 1.304mol$

Mol. Mass of Methanol. $CH_3OH = 32$

No of moles of methanol = $\frac{40g}{32gmol^{-1}} = 1.25mol$

X_A Mole fraction of Ethanol = $\frac{1.304}{1.304 + 1.25} = 0.5107$

X_B Mole fraction of methanol = $\frac{1.25}{1.304 + 1.25} = 0.4893$

Partial Pressure of Ethanol P_A = $X_A P_A^0 = 0.5107 \times 44.5$

=22.73 mm of Hg

Partial pressure of Methanol $P_B = X_B P_B^0 = 0.4893 \times 88.7$

$= 43.40$ mm of Hg

Total vapour pressure of solution $P_T = P_A + P_B = 22.73 + 43.40 = 66.13$ mm of Hg

45.

$$M_B = \frac{K_b \times W_B \times 1000}{\Delta T_b \times W_A}$$

$$\Delta T_b = T_b - T_b^0$$

$$= 354.11 - 353.23 = 0.88\,K$$

$$M_B = \frac{2.52 \times 1.8 \times 1000}{0.88 \times 90}$$

$$= 57.27\ gmol^{-1}$$

46. Given : I = 5A

Time = 20×60 = 1200 s

$\therefore$ total charge = I × t = 5 × 1200 = 6000 C

According to the reaction

$$Ni^{+2}_{(aq)} + 2e^{-1} \rightarrow Ni(s)$$

Ni deposited by (2×96487)C = 58.7g

$$\therefore \text{Ni deposited by } 6000\,C = \frac{58.7 \times 6000}{2 \times 96487}$$

$$= 1.825g$$

47. $E^0_{cell} = E^0_{(Ag^+/Ag)} - E^0_{(Mg^{2+}/Mg)} = 0.80V - (-2.37V) = 3.17V$

The Nernst equation is

$$E_{cell} = E^0_{cell} - \frac{RT}{nF} \ln \frac{[Mg^{2+}]}{[Ag^+]}$$

$$E_{cell} = 3.17V - \frac{0.0591V}{n} \log \left[\frac{(0.001)}{(0.0001)^2} \right]$$

$$E_{cell} = 3.17V - \frac{0.0591V}{2} \times 5$$

$$E_{cell} = 3.17V - 0.147V$$

$$E_{cell} = +3.317V$$

48. i) Differential rate equation

Rate r = K[A] [B]^2 .....(1)

ii)On increasing the concn. of B three times

Rate r_2 = K[A] [3B]^2 .....(2)

$$\frac{r_2}{r_1} = \frac{K[A][3B]^2}{K[A][B]^2} = 9$$

$$\therefore r_2 = 9r_1$$

ie .Rate increasing 9 times

iii)When the concn. of both A & B are increased by two times

rate $r_3 = K[2A][2B]^2$

$$\frac{r_3}{r_1} = \frac{K[2A][2B]^2}{K[A][B]^2} = 8$$

$$\therefore r_3 = 8r_1$$

ie. Rate increasing 8 times

49. T_1=300K, T_2=400K, $\therefore T_2-T_1$=100K,

K_1=0.0345 s^{-1}, K_2=0.136 s^{-1}

R = 8.314 $JK^{-1}mol^{-1}$

$$E_a = \frac{2.303RT_1T_2}{T_2 - T_1}\log_{10}\frac{k_2}{k_1}$$

$$= \frac{2.303 \times 8.314 \times 300 \times 400}{100}\log\frac{0.136}{0.034}$$

$$= \frac{2.303 \times 8.314 \times 300 \times 400 \times 0.6021}{100}$$

$$= 13833.27J$$

$$E_a = 13.83327KJ$$

****

Model Question Paper-8
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks :70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. At a given temperature, osmotic pressure of a concentrated solution of a substance is
   a) Higher than that of a dilute solution b) Lower than that of a dilute solution
   c) Is same as that of a dilute solution
   d) Cannot be compared with osmotic pressure of dilute solution.
2. On charging the lead storage battery, $PbSO_{4(s)}$ on cathode is converted into
   a) PbO_2 b) Pb c) PbO d) PbS .
3. An electrochemical cell can behave like an electrolytic cell when
   a) $E_{cell}=0$ b) $E_{cell}>E_{ext}$ c) $E_{ext}>E_{cell}$ d) $E_{cell}=E_{ext}$
4. The role of catalyst is to change
   a) Gibb's energy of reaction b) Enthalpy of reaction
   c) Activation energy of reaction d) Equilibrium constant.
5. The paramagnetic/ coloured ion among the following is
   a) Ti^{3+} b) Cu^{+} c) Zn^{2+} d) Sc^{3+}.
6. The solution of the complex $K_4[Fe(CN)_6]$ in water will
   a) Give the test for K^+ ions b) Give the test for Fe^{2+} ions
   c) Give the test for CN^- ions d) Not give the tests for all the above ions.
7. Phosgene is commonly known as
   a) thionyl chloride b) Carbonyl dichloride
   c) Carbon dioxide and phosphine d) Phosphoryl chloride.
8. Acidic nature of alcohols decreases in the order
   a) $1^0 > 2^0 > 3^0$ b) $3^0 > 2^0 > 1^0$ c) $3^0 > 1^0 > 2^0$ d) $2^0 > 1^0 > 3^0$.
9. Phenol reacts with zinc dust to give
   a) Benzene b) Benzoic acid c) benzaldhyde d) Cumene.

10. Aldehyde which does not undergo cannizzaro reaction is
    a) HCHO b) CH_3CHO
    c) C_6H_5CHO d) All the three (a),(b) &(c).
11. Aromatic carboxylic acids do not undergo which of the following electrophilic substitution reaction?
    a) Nitration b) Chlorination
    c) Sulphonation d) Friedel-crafts reaction.
12. Which of the following amines cannot be prepared by Gabriel synthesis
    a) Methanamine b) Ethanamine
    c) Propanamine d) Aniline.
13. Primary,secondary and Tertiary amines can be distinguished by
    a) Schiff's reagent b) Fehling's reagent
    c) Tollen's reagent d) Hinsberg's reagent
14. Which of the following does not have glycosidic linkage?
    a) Sucrose b) Amylose c) Galactose d) Maltose
15. Which of the following nitrogenous bases is not present in DNA
    a) Uracil b) Adenine c) Cytosine d) Thymine

II. Fill in the blanks by choosing the appropriate word from those given in the brackets:
[Lanthanoids, 9, Nitrogen , Carbocation, 3, Plane of symmetry] **1x5=5**

16. Van't Hoff factor for potassium sulphate ,if it undergoes dissociation completely is -----
17. For a reaction A→B, Rate law expression is given by Rate = $k[A]^2$ .When concentration of the reactant is increased by three times then rate increases by -------- times.
18. The elements in which electrons are progressively filled in 4f orbital are called--------
19. Meso compounds are optically inactive due to ----------
20. The gas liberated when ethyl amine reacted with HNO_2 at low temperature is ---------

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. State Henry's law.give its mathematical form.
22. Write any two differences between order and molecularity of a reaction.
23. What is heteroleptic complex? Give one example.
24. Explain Finkelstein reaction with an example.
25. How do you prepare an aldehyde from acid chloride? Name the reaction.
26. Write the Haworth structure of maltose.

Part-C

IV. Answer any three of the following. Each question carries three marks : **3x3=9**

27. What are interstitial compounds? Write any two of their characterstics.
28. Write the balanced equations for the reactions involved in the preparation of $K_2Cr_2O_7$ from chromite ore.

29. What is lanthanoid contraction? Mention two consequences of lanthanoid contraction.
30. State any three postulates of Werner theory of coordination compounds.
31. Explain the hybridization, geometry and magnetic properties of $[CoF_6]^{3-}$ ion using VBT.
32. What is geometrical isomerism in coordination complexes? Write the structure of cis and trans isomer of $[Pt(NH_3)_2Cl_2]$.

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Name any two colligative properties. On what factor the value of colligative property depends?
34. Draw a neat labeled diagram of H_2-O_2 fuel cell. Write equation for cathodic, anodic reactions.
35. Mention any three factors on which conductivity of an electrolyte solution depends.
36. Derive an integrated rate equation for the rate constant of a first order reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a) Explain S_{N^1} mechanism with an example.

    b) What is (i) Chirality?

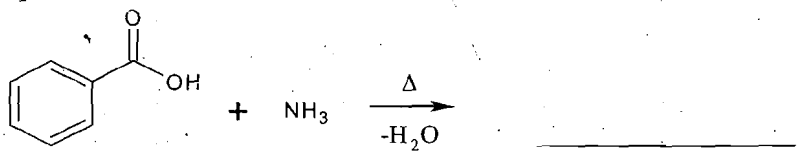
    (ii) Racemic mixture?

38. a) Write the mechanism of acid catalyzed dehydration of ethyl alcohol to ethene.
    b) How do you convert phenol to 2-Hydroxy benzoic acid? Write the equation.
39. a) How is phenol manufactured by cumene process? Explain
    b) Name the main product formed in the following reaction.

    i) $(CH_3)_3ONa + CH_3Cl \rightarrow$

    ii) $H_3C{-}CH_2{-}OH \xrightarrow[413K]{H_2SO_4}$ _____

40. a) Name the product obtained in the addition of alcohols is to aldehydes. What is the role of dry HCl in this reaction
    b) Ketones are generally less reactive towards nucleophilic addition reactions. Give any two reasons.
    c) Which is the product formed when acetone undergoes Wolf–Kishner reduction?
41. a) Explain decarboxylation reaction with an example.
    b) Among formic acid and acetic acid which is more acidic and why?
    c) Complete the reaction.



_____

42. a) Find 'A' and 'B'

$$H_5C_6{-}CH_2{-}Cl \xrightarrow{NH_3} A \xrightarrow{2CH_3Cl} B$$

b) Explain how does aniline reacts with bromine water, write the equation.

c) Arrange following compounds in the decreasing order of basi c strength in aqueous solution:

$CH_3NH_2, (CH_3)_2NH, (CH_3)_3N, NH_3$

43.a) How many primary and secondary –OH groups are present in a glucose molecule?

b) What is zwitter ion? Write its formula.

c) Give an example for water soluble vitamin.

PART-E

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. Vapour pressure of benzene is 200 mm of Hg. When 2 g of non volatile solute is dissolved in 78g of benzene, benzene has a vapour pressure of 195 mm of Hg. Calculate the molar mass of solute.(molar mass of benzene =78 g/mol).

45. One gram of sucrose (Mol.mass 342g/mol) is dissolved in 100mL of solution at 25^0C.Calculate the osmotic pressure.($R = 0.082$ L atm $mol^{-1}K^{-1}$)

46. Calculate the emf of the cell in which the following reaction takes place and represent the cell.

$Ni_{(s)} + 2Ag^+_{(0.002M)} \rightarrow Ni^{2+}_{(0.160M)} + 2Ag_{(s)}$ (Given $E^0_{cell} = 1.05V$)

47. Λ^0_m for NaCl ,HCl and CH_3COONa are 126.4, 425.9 and 91.0 S cm^2mol^{-1} respectively. Calculate Λ^0_m for CH_3COOH.

48. The rate of a particular reaction doubles when the temperature changes from 300 K to 310K. Calculate the energy of activation of the reaction.(Given $R = 8.314$ J K^{-1} mol^{-1})

49. A first order reaction has a rate constant 1.15×10^{-3} s^{-1}.How long will 5 g of this reactant take to reduce to 3g?

Answers

I.

1. a) Higher than that of a dilute solution
2. a) PbO_2
3. c) $E_{ext} > E_{cell}$
4. c) Activation energy of reaction
5. a) Ti^{3+}
6. a) Give the test for K^+ ions
7. b) Carbonyl dichloride
8. a) $1^0 > 2^0 > 3^0$
9. a) Benzene
10. b) CH_3CHO
11. d) Friedel-crafts reaction.
12. d) Aniline
13. d) Hinsberg's reagent
14. c) Galactose
15. a) Uracil

II.

16. 3
17. 9
18. Lanthanoids
19. Plane of symmetry
20. Nitrogen

III.

21. The partial pressure of the gas in vapour phase(p) is proportional to the mole fraction(x) of the gas in the solution.

    $p = K_H x$

22.

Order of a reaction	**Molecularity of a reaction**
1. It is the sum of the powers of the concentration of the reactants in the rate law expression.	1.The number of reacting species collide simultaneously to bring about areaction is called molecularity of a reaction
2.It can be a whole number or fraction or zero	2. It is always a whole number.
3. It is experimentally determined value.	3.It is a theoretical value

Any two differences

23. Heteroleptic complexes are the complexes in which metal is bound to more than one kind of ligands.

e.g: $K_4[Fe(CN)_4Cl_2]$ or $[Co(NH_3)_4Cl_2]^+$ or any one other example

24. In Finkelstein reaction, iodoalkanes are prepared by the reaction of alkyl chlorides or bromides with sodium iodide in dry acetone.

e.g :

$$CH_3Br + NaI \xrightarrow[\Delta]{\text{dry acetone}} CH_3I + NaBr$$

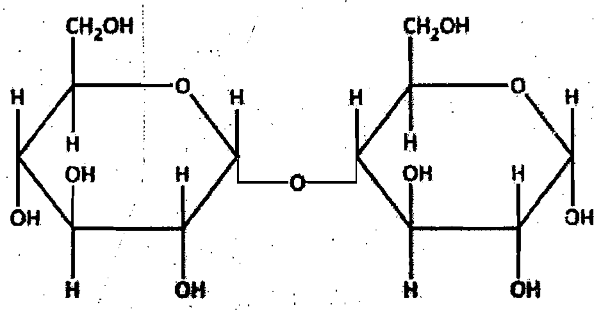
25. Acid chloride is hydrogenated over Pd on $BaSO_4$ to give an aldehyde.

Or

$$R\text{-}CO\text{-}Cl \xrightarrow[Pd\text{-}BaSO_4]{H_2} R\text{-}CHO + HCl$$

Rosenmund reaction

26.



IV.

27. Interstitial compounds are the compounds formed when small atoms like H, C or N are trapped inside the crystal lattice of metals.

Their characteristics:

i) They have high melting points, higher than those of pure metals

ii) They are very hard

iii) They retain metallic conductivity

iv) They are chemically inert.

(Any two characteristics)

28. $4\,FeCr_2O_4 + 8\,Na_2CO_3 + 7\,O_2 \rightarrow 8\,Na_2CrO_4 + 2\,Fe_2O_3 + 8\,CO_2$

$2\,Na_2CrO_4 + 2\,H^+ \rightarrow Na_2Cr_2O_7 + 2\,Na^+ + H_2O$

$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$

29. The overall decrease in atomic and ionic radii from lanthanum to lutetium is called lanthanoid contraction.

Its consequences:

i) Similarity in atomic size of elements of second and third transition series.

ii) The separation of lanthanides in pure state becomes difficult.

30. Postulates of Werner's theory:

i) Central metal atom in the coordination compound possess two types of valencies. They are primary valency and secondary valency.

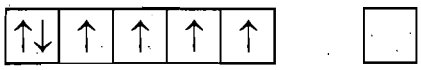
ii) Primary valency is generally ionisable, secondary valency is non-ionisable.

iii) Primary valencies are satisfied by negative ions, while secondary valencies are satisfied by neutral molecules or negative ions called ligands.

iv) Primary valency is non-directional; where as secondary valency is directional and it gives definite geometry to the complex.

(Any three of the above postulates)

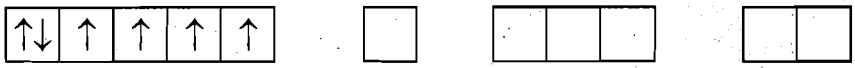
31. Electronic configuration of Co^{3+} - $[Ar]\,3d^6 4s^0$



3d 4s

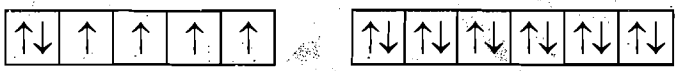
In the presence of F^-, 3d electrons do not pair up

sp^3d^2 hybridised orbitals of Co^{3+} :



3d 4s 4p 4d

$[CoF_6]^{3-}$:

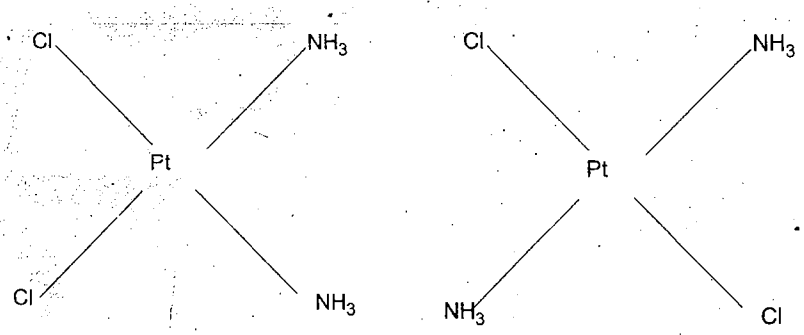


3d sp^3d^2

Magnetic property: paramagnetic

Geometry: Octahedral

32. Geometrical isomerism is isomerism which arises in heteroleptic complexes due to different possible geometric arrangements of the ligands.



cis trans

V

33. Colligative properties:

i) Relative lowering of vapour pressure

ii) Elevation in the boiling point

iii) Depression in the freezing point

iv) Osmotic pressure (any two)

34.

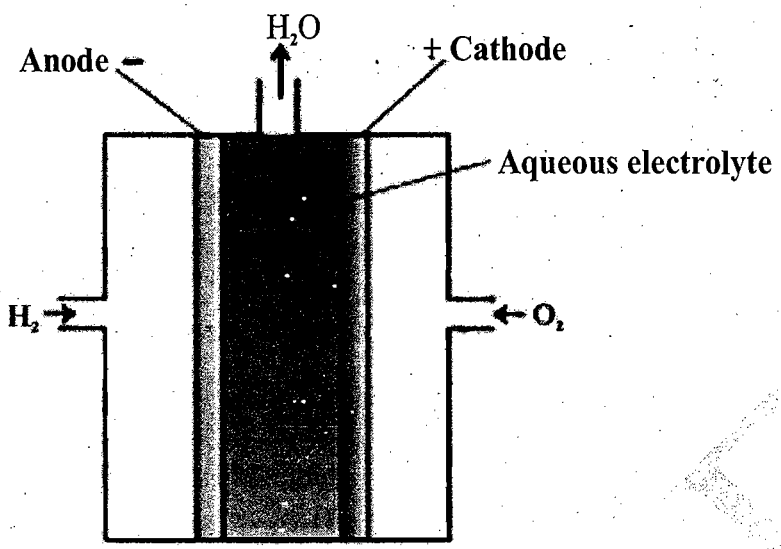


Fig: H_2-O_2 Fuel Cell

Cathode: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

Anode: $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$

35. i) Nature of electrolyte
ii) Nature of the solvent and its viscosity
iii) Concentration of the electrolyte solution
iv) Temperature Any three

36. Consider a first order reaction R→P

$$\text{Rate} = -\frac{d[R]}{dt} = k[R]$$

Or $$\frac{d[R]}{dt.} = -k[R]$$

Integrating this equation, we get

$\ln [R] = -kt + I$ ---------- (1)

when t=0, R = $[R]_0$, where R = $[R]_0$, where $[R]_0$ is the initial concentration of the reactant.

Therefore, equation (1) can be written as

$\ln [R]_0 = -k(0) + I$

$\ln [R]_0 = I$

Substituting the value of' I' in equation (1)

$$\ln [R] = -kt + \ln [R]_0$$

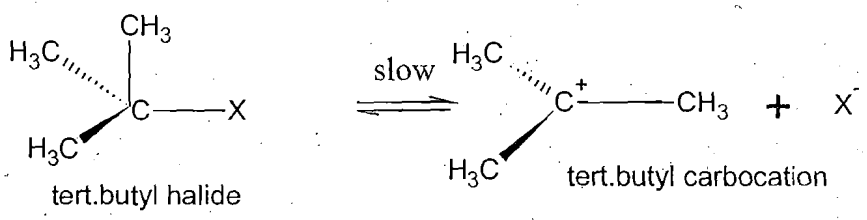
or $$\ln \frac{[R]}{[R]_0} = -kt$$

or $k = \frac{1}{t} \ln \frac{[R]_0}{[R]}$ OR $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$

VI.

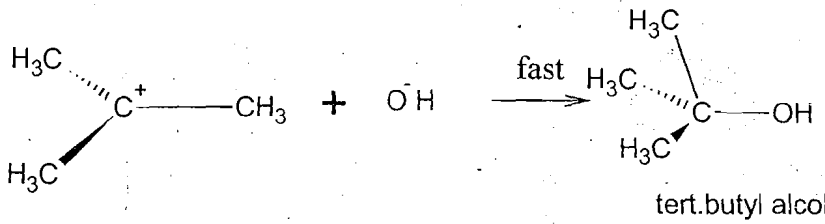
37.(a)The S_N1 mechanism is a two step process, first one being the slow where formation of carbocation takes place and the rate determining step.In the second step attack of nucleophile to the carbocation takes place.

Step-1



tert.butyl halide tert.butyl carbocation

Step-2



tert.butyl alcohol

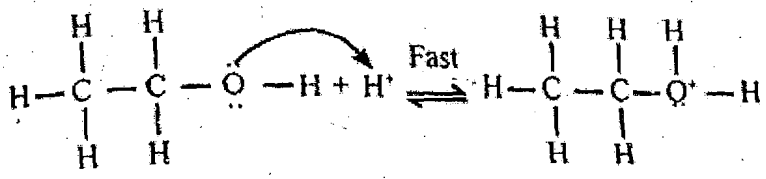
The reaction follows first order kinetics.The rate of reaction is independent of the concentration of nucleophile.

(b) (i) The property of a molecule to have non super imposable mirror image is called chirality.

(ii) A mixture containing two enantimers in equal proportions will have zero optical rotation is called racimic mixture.

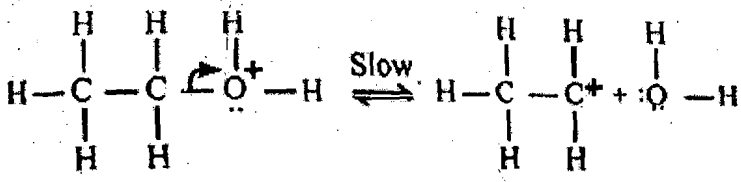
38. (a)

Step 1 : Formation of protonated alcohol

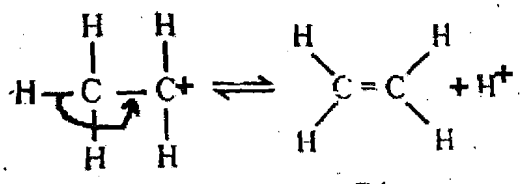


Protonated alcohol

Step 2 : Formation of Carbocation. It is slowest step and rate determining step.

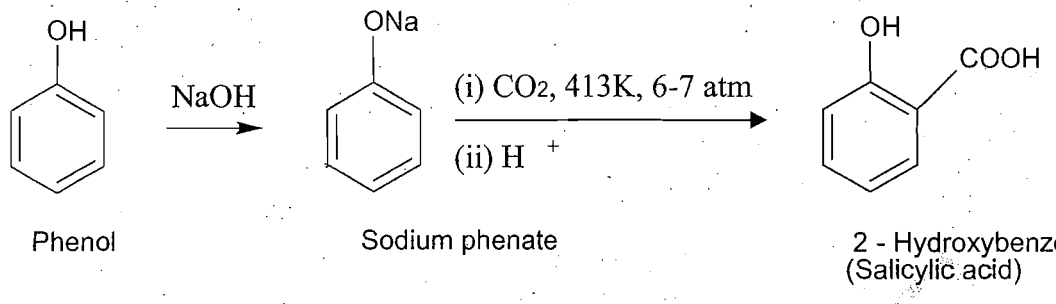


Step 3 : Formation of ethene by elimination of proton.



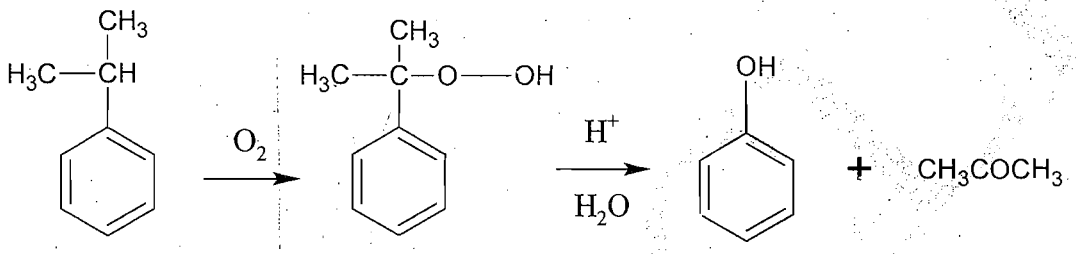
Ethene

(b) When phenol is treated with NaOH forms sodium phenate, which on treatment with carbon dioxide and on acid hydrolysis gives 2-Hydroxy benzoic acid or salicylic acid.



Phenol — Sodium phenate — 2 - Hydroxybenzoic acid (Salicylic acid)

39.(a)Cumene is oxidized in the presence of air to cumene hydroperoxide. It is converted to phenol and acetone by treating it with dilute acid.



cumene — cumene hydroperoxide — Phenol

(b) i) Tertiary butyl methyl ether.
ii) Diethylether.

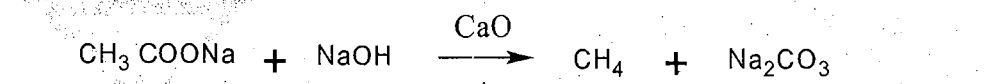
40.(a)Acetal

Dry HCl protonates the oxygen atom and increases the electrophilicity on carbonyl carbon.

(b) i) Due to steric hindrance of bulky groups
ii) Electromeric effect.

(c) Propane or $CH_3CH_2CH_3$.

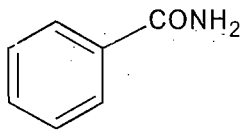
41.(a)When carboxylic acid salts are heated with sodalime, decarboxylation takes place to form hydrocarbons.



Sodium acetate — Methane — Sodium carbonate

(b) Methanoic acid is more acidic.
Due to +I effect in ethanoic acid

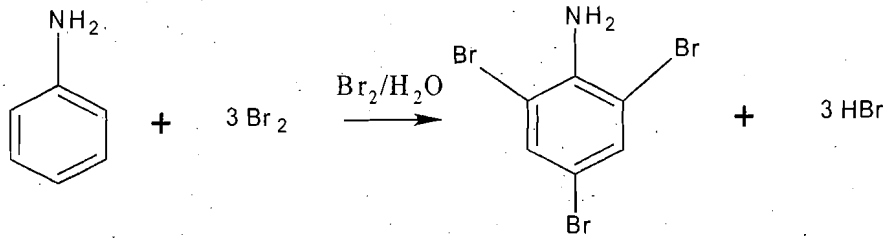
(c)



42.(a) A= $C_6H_5CH_2NH_2$

B = $C_6H_5CH_2N(CH_3)_2$

(b) Aniline reacts with bromine water at room temperature to give a white precipitate of 2,4,6-tribromoaniline.



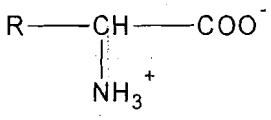
2,4,6 -Tribromoaniline

(c) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

43.(a) primary-01

Secondary-04

(b) In aqueous solution amino acids exist as a dipolar ion called zwitter ion.



(c) Vitamin B or Vitamin C

VII. 44. Given, $p_1^0 = 200$ mm Hg, $w_2 = 2g, w_1 = 78g$

$p_1 = 195$ mm Hg, $M_1 = 78$ g/mol, $M_2 = ?$

$$\frac{p_1^0 - p_1}{p_1^0} = \frac{w_2 \times M_1}{M_2 \times w_1}$$

$$\frac{200 - 195}{200} = \frac{2 \times 78}{M_2 \times 78}$$

$M_2 = 80\ g\ mol^{-1}$

45. Given, V = 100ml = 0.1L, $w_2 = 1g$, $T = 25^0C = 298K$, $M_2 = 342\ g\ mol^{-1}$, $\pi = ?$

$$\pi = \frac{w_2 RT}{M_2 V}$$

$$\pi = \frac{1 \times 0.082 \times 298}{342 \times 0.1}$$

$= 0.714$ atm

46. Given $[Ni^{+2}] = 0.16014$, $[Ag^+] = 0.002M$, n=2

$$E_{cell} = E^0_{cell} - = \frac{0.059}{n} \log_{10} \frac{[Ni^{2+}]}{[Ag^+]^2}$$

$$= 1.05 - \frac{0.059}{n} \log_{10} \frac{[0.160]}{[0.002]^2} = 0.914\ V$$

47. Given, $\lambda^0_{Na^+}+\lambda^0_{Cl^-} = 126.4\ Scm^2\ mol^{-1}$, $\lambda^0_{H^+}+\lambda^0_{Cl^-} = 425.9\ Scm^2\ mol^{-1}$

$\lambda^0_{Na^+}+\lambda^0_{CH_3COO^-} = 91.0\ Scm^2\ mol^{-1}$, $\Lambda^0_{m(CH_3COOH)} = ?$

$$\Lambda^0_{m(CH_3COOH)} = \lambda^0_{CH_3COO^-}+\lambda^0_{H^+} = \lambda^0_{H^+}+\lambda^0_{Cl^-}+\lambda^0_{Na^+}-\lambda^0_{Cl^-}-\lambda^0_{Na^+}$$

$$= \Lambda^0_{m(HCl)} + \Lambda^0_{m(CH_3COONa)} - \Lambda^0_{m(NaCl)}$$

$$= 425.9 + 91.0 - 126.4$$

$$= 390.5\ Scm^2\ mol^{-1}$$

48. Given $T_1 = 300K$, $T_2 = 310K$, $\frac{k_2}{k_1} = 2$, $E_a = ?$

$$\log \frac{k_2}{k_1} = \left[\frac{E_a}{2.303R}\right]\frac{T_2 - T_1}{T_1T_2}$$

$$\log 2 = \frac{E_a}{2.303 \times 8.314}\left[\frac{310-300}{300 \times 310}\right]$$

$$E_a = 53598J = 53.598\ kJ$$

49. Given, $k = 1.15 \times 10^{-3}\ s^{-1}$, $[R]_0 = 5g$, $[R] = 3g$, $t = ?$

$$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$$

$$1.15\times10^{-3}\ s^{-1} = \frac{2.303}{t}\log\frac{5}{3}$$

$$t = 444s$$

****

Model Question Paper-9
Chemistry

Time : 3 Hrs. 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=15**

1. De Salination of Sea Water can be done by
   a) Dialysis b) Distillation c) Evaporation d) Reverse Osmosis
2. A Several blocks of Magnesium are fixed to the bottom of a ship due to
   a) Keep away the Sharks b) Make the Ship lighter
   c) Prevent action of water and salt d) Prevent puncture by under- sea rocks
3. Order of a reaction is decided by
   a) Slow Step b) Fast Step c) Intermediate Step d) None of the above
4. The Electronic configuration of outer orbital of Zn, Cd and Hg are represented by the general formula
   a) $(n-1)d^{1-10}ns^2$ b) $(n-1)d^{10}ns^1$
   c) $(n-1)d^{10}ns^2$ d) $(n-1)d^{1-10}ns^{1-2}$
5. The IUPAC name of tertiary butyl chloride is
   a) 2-Chloro-2-methyl propane b) 3-Chloro butane
   c) 4-Chloro butane d) 2-chloro-3methyl Propane
6. In Lucas reagent test of alcohols, the appearance of turbidity is due to the formation of
   a) Aldehydes b) Ketones c) Acid Chloride d) Alkyl Chloride
7. The Liquid 'X" was mixes with methanol and a drop of concentrated H_2SO_4 was added, A compound with a fruity odour was formed, then Liquid 'X" is
   a) CH_3CHO b) CH_3COCH_3 c) CH_3COOH d) CH_3CH_2OH
8. Which one of the following is not an Amine
   a) CH_3NH_2 b) $C_6H_5(CH_3)_2N$ c) CH_3CONH_2 d) $C_6H_5NH_2$
9. Cheilosis and digestive disorders are due to the deficiency of
   a) Vitamin A b) Riboflavin c) Thiamine d) Ascorbic acid

10. The unit of rate constant of a Zero order reaction is
    a) mol L^{-1} b) S^{-1}
    c) mol $L^{-1}S^{-1}$ d) mol S^{-1}
11. Which of the following is depend on temperature
    a) Molarity b) Molality c) Mole fraction d) Mass percentage (W/W)
12. Carbohydrates are stored in human body as the polysaccharide
    a) Starch b) Glycogen c) Cellulose d) Amylose
13. If a Salt bridge is removed from the two half cells, then the Voltage.
    a) Drops to Zero b) Does not Change c) Increase gradually d) Increase rapidly
14. Magnetic behavior shown by aqueous colorless solution of metal ion of 3d series is
    a) Paramagnetic b) Ferromagnetic c) Diamagnetic d) Anti-ferromagnetic
15. The gas liberated, when aliphatic primary amine reacts with Nitrous acid
    a) NH_3 b) N_2
    c) H_2 d) C_2H_6

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: (Rhodium complex, ethane, methanol, chromyl chloride, methylamine, methane) **1x5=5**

16. Wilkinson Catalyst is a _____
17. When methyl bromide undergoes wurtz reactions, the product obtained is _____
18. Blindness is caused by consumption of _____
19. The oxidizing agent used in Etard's reaction is _____
20. Carbylamine test is given by _____

Part-B **3x2=6**

III. Answer any three of the following. Each question carries two marks:

21. Mention any two applications of Henry's Law.
22. What are the conditions for the effective collisions between reactant molecules?
23. What is Linkage isomerism? Give one example.
24. State Saytzeff's rule (zaitsev) with an example.
25. Explain the following reaction.

$$2CH_3CHO \xrightarrow{\text{dil NaOH}}$$

26. Write the Haworth's Structure for Sucrose (Cane Sugar)

Part-C **3x3=9**

IV. Answer any three of the following. Each question carries three marks :

27. Write the balanced equations for the preparation of potassium permanganate from MnO_2
28. Explain the hybridization, geometry and magnetic property of $[Ni(CN)_4]^{2-}$
29. Give any three differences between Lanthanides and actinoids.
30. What is crystal field splitting energy? How does the magnitude of Δ_0 decide the actual

31. Mention any three uses of d – block elements.
32. What are metal carbonyls? Explain the synergic effect on metal carbonyls.

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. What is the significance of Van't Hoff's factor?
34. Explain the construction and working of a Daniel Cell.
35. Write a note on specific conductance (K) and molar conductivity (λ_m) with concentration of solution or dilution.
36. Derive integrated rate equation for rate constant of Zero order reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a) Explain the mechanism involved in the conversion of tertiary butyl bromide into tertiary butyl alchol.
    b) Give reason's Aryl halides are less reactive towards Nucleophilic substitution reaction
38. a) What is Lucas reagent? How does it is used to distinguish primary, secondary and tertiary alcohols..
    b) How do you convert phenol to Salicylic acid by Kolbe's process?
39. a) Explain the Mechanism of acid catalyzed hydration of alkenes to alcohols.
    b) Write the Name and Product of the following reaction.

$$CH_3Br + CH_3O^-Na^+ \longrightarrow A + NaBr$$

40. a) Write chemical reactions for the following transformation.
    (i) Butan-1-ol to butanoic acid
    (ii) Cyclohexene to hexane-1, 6 – dioic acid.
    b) Explain the effect of substituents on the acidity of carboxylic acids.
41. a) What is Wolff-Kishner reduction? Give an example.
    b) Explain the reaction of 2, 4- DNPH reagent with an aldehyde.
42. a) An aromatic Compound 'A' on treatment with aqueous ammonia and heating forms compound 'B', which on heating with Br_2 and KOH forms a compound 'C' of molecular formula C_6H_7N, Write the names of compounds A, B and C.
    b) Give reasons (1) Aliphatic amines of low molecular mass soluble in H_2O
    (2) Dimethylamine is more Basic than methylamine.
43. a) How do you show that Glucose contains 6 Carbon atoms in a straight chain.
    b) What are Globular proteins? Give one example.
    c) How many hydrogen bonds are present between Adenine and Thymine in DNA

PART-E

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. H_2S, a toxic gas with rotten egg like smell is used for qualitative analysis. If the solubility of H_2S in water at S.T.P is 0.195m. Calculate Henry's law constant. (No. of moles of H_2O = 55.55 mole)

45. Calculate the osmotic pressure of 5% (m/v) solution of urea at 300K. Molar mass of urea is 60g/mol. ($R=0.821 LatmKmol^{-1}$)

46. In the button cells widely used in watches following reaction takes place.

$$Zn(s) + Ag_2O + H_2O(l) \longrightarrow Zn^{2+}(aq) + 2Ag(s) + 2OH^-(aq)$$

Determine ΔG^0 and E^0 for the reaction

($E^0_{Zn} = -0.76$ V) $E^0_{Ag} = +0.80$V

47. Calculate the emf of the following cell using Nernst equation at 298K.

$$Fe(s) \mid Fe^{2+}_{(0.001M)} \parallel H^+_{(1M)} \mid H_2(g)\,(1bar) \mid Pt(s).$$

($E^0_{Fe^{2+}} = -0.44V$), $E^0_{H^+} = 0.0V$)

48. The rate of a particular reaction doubles when temperature changes from 27^0 C to 37^0 C, calculate the Energy of activation. $R=8.314 JK^{-1}mol^{-1}$

49. In a first order reaction, the concentration of a reactant decreases from 400 mol L^{-1} to 25 mol L^{-1} in 200 Seconds. Calculate the Rate constant for the reaction.

Answers

I.

1. d] Reverse Osmosis
2. c] Prevent action of Water and Salt.
3. a] Slow Step
4. c] $(n-1)\,d^{10}\,ns^2$
5. a] 2 – chloro-2-methyl propane
6. d] Alkyl Chloride
7. c] CH_3COOH
8. c] CH_3CONH_2
9. b] Riboflavin
10. c] $mol\,L^{-1}S^{-1}$
11. a] molarity
12. b]Glycogen
13. a] Drops to Zero
14. c] Diamagnetic
15. b]N_2

II.

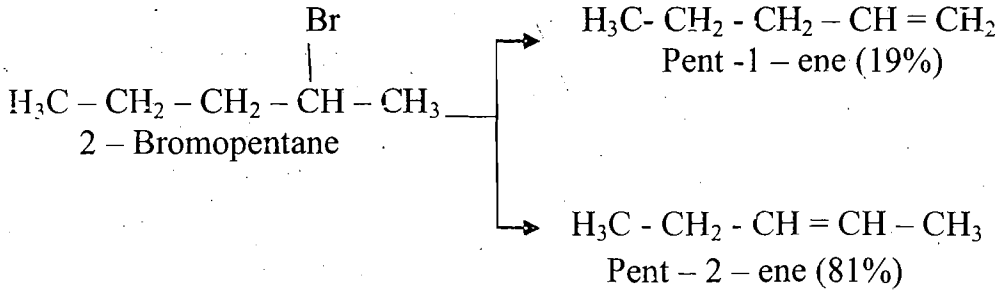
16. Rhodium Complex
17. Ethane
18. Methanol
19. Chromyl Chloride
20. Methylamine

III. 21. a) As the pressure increases solubility of gas in the solution is also increases.-Deep Sea Diving
b) As the temperature increases solubility of gas in the solution is decreases -Soft drinks stored in refrigerator.

22. a) Activation energy
b) Proper orientation of the molecules.

23. It arises in the co-ordination compound containing ambidentate ligand due to bonding with different linking atom.
Ex.: $[CO(NH_3)_5ONO]^{2+}$ and $[CO(NH_3)_5NO_2]^{2+}$

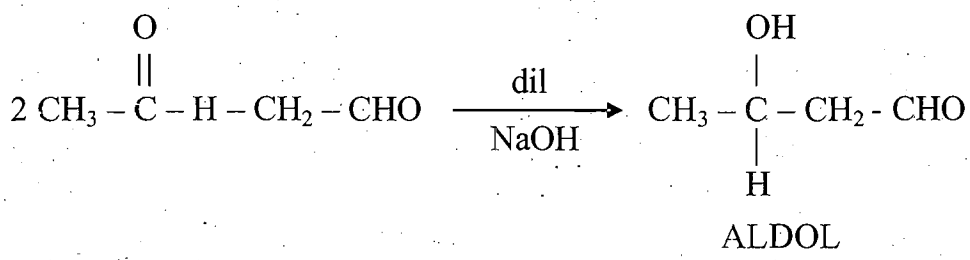
24.



In Dehdrohalogenation reactions, the preferred product is that alkene which has the greater number of alkyl groups attached to the doubly bonded carbon atoms.

25. ALDOL Condensation.

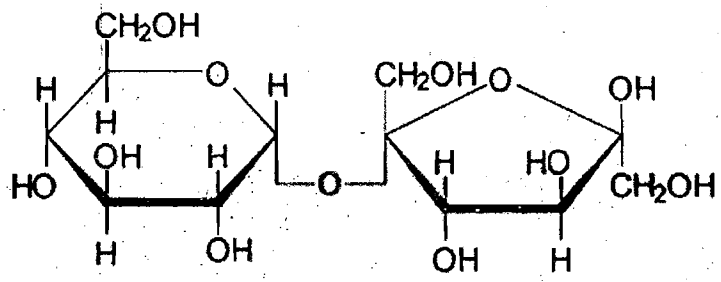
2 molecules of Aldehydes and Ketones containing at least α-hydrogen atom undergo self-condensation in presence of dilute alkali to form a β- hydroxyl aldehyde or hydroxy Ketone respectively.



ALDOL

Explanation - 1M
Reaction - 1M
Self- explanatory equation – 2M

26.



IV.

27. **1st Step:** The powdered pyrolusite (MnO_2) fused with potassium hydroxide and on oxidizing agent like KNO_3 / air to form dark green potassium manganate.

$$2\,MnO_2 + 4\,KOH + O_2 \xrightarrow{\Delta} 2\,K_2MnO_4 + 2H_2O$$

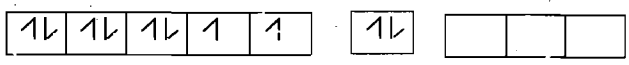
Potassium Manganate (Green Colour)

2nd Step: Potassium manganate undergoes disproportion in acidic (or) neutral medium to form permanganate.

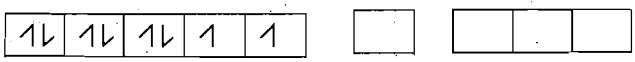
$$3\,MnO_2 + 4\,H^+ \longrightarrow 2\,MnO_4^- + MnO2 + 2H_20$$

(Violet Colour)

28. The Oxidation State of Nickel in $[Ni(CN)_4]^{2-}$ is +2.

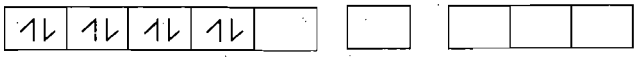
The E.C of Ni in Ground State $= [Ar]^{18}$ 

$3d^8$ $4s^2$ 4p

The E.C of Ni^{+2} ion G.S = $[Ar]^{18}$ 

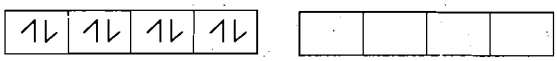
$3d^8$ $4s^0$ 4p

CN^- is a Strong ligand forced unpaired d – electrons to pair up.

The E.C of Ni^{+2} = $[Ar]^{18}$ 

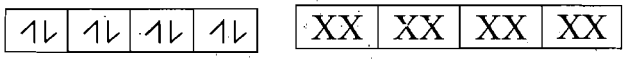
$3d^8$ $4s^0$ 4p

One 3d, one 4s and two 4p orbitals undergo dsp^2 hydridisation to form 4 dsp^2 hybrid orbitals to give square planer shape.

dsp^2 hybrid orbitals of Ni^{2-} = 

$3d^8$ d s p^2

Hybrid orbitals.

Formation of $[Ni(CN)_4]^{2-}$ = 

$3d^8$ 4 Pairs & CN^- ligands.

Hybridisation = dsp^2
Geometical Shape = Square planar
Magnetic property = diamagnetic due to absence of unpaired electrons.

29. Any three differences - 3 M

Lanthanoids	Actinoids
1.Electrons enter into 4f orbitals	1. Electrons enter into 5f orbitals .
2. They are radioactive except promethium.	2. All are radioactive.
3. Binding energies of 4f electrons are higher	3. Binding energies of 5f electrons are lower.
4.They are less basic	4. They are more basic
5. Maximum oxidation state is +4	5. Maximum oxidation state is +7.
6.4f electrons have greater shielding effect	6. 5f electrons have poor shielding effect.
7. Lanthanoid contraction is lesser	7. Actinoids contraction is greater.

30. The splitting of degenerated five d-orbitals due to entry of ligands into t_{2g} and e_g energy levels called crystal field splitting and the energy difference between t_{2g} and e_g is called crystal field splitting energy in octahedral complex.

'P' represents the energy required for electron pairing in a single orbital.

upto d^3 ion, electron enters according to Hund's Rule.

After d^4 ion two possible ways.

a] If $\Delta_0 > P$. The fourth electron occupy t_{2g} orbitals with configuration $t_{2g^4 eg^1}$. The ligands are called as strong field ligands and Weak spin complex.

b] If $\Delta_0 < P$, $t_{2g^3 eg^1}$. Ligands which shows this effect are weak field ligands and forms high Spin complex.

31. Any three uses of d- block elements
    1. Iron and steel used as construction materials
    2. TiO and other oxides used in pigment industry
    3. MnO_2 used in Dry battery cells and Zn, Ni and Cd used in battery cells.
    4. Cu / Ni alloy is used for making coins
    5. $TiCl_4$ with $[Al(C_2H_5)_3]$ Ziegler – Natta catalyst used in the preparation of Poly ethenes
    6. Used as catalyst in many industrial productions.
    7. AgBr has special light sensitive properties in photography.
    8. $PdCl_3$ is used as the catalyst in the oxidation of Ethyne to Ethanol in wacker process.
    9. Nickel complexes are useful in the polymerization of alkynes and other organic compounds like Benzene etc.

32. Organo metallic compounds containing carbonyl ligands are called Metal Carbonyls it contains both σ & π – character.

    The M-C bond is formed due to the donation of lone pair of electrons of carbon atoms of CO to vacant orbital of Metal atom.

    The M- C π bond is formed by the donation of a pair of electrons from the filled d-orbital of Metal into Vacant anti bonding orbital of CO Known as Back – bonding.

    Due to this, Bond strength between metal and Carbon increases and Carbon and oxygen decreases is called Synergic effect in Metal Carbonyls.

V.

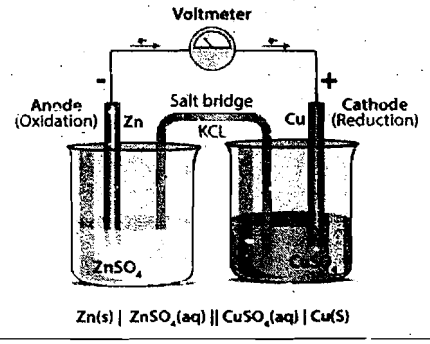
33. i) If i=1, the solute does not undergo either association or dissociation.
    ii) If i>1, solute undergo dissociation
    iii) If i<1, solute undergo association.

34. **Daniel Cell.**

    Construction: It is combination of Zinc half cell and copper half cell, inter-connected by a Salt bridge, the two electrodes are connected externally through a Voltmeter and a Switch

    OR

    If drawn labeled diagram - Give (1M)



Working: Zinc electrode shows tendency to undergo oxidation and act as anode, where as copper electrode undergoes reduction, electrons liberated at anode move to cathode, while current flows from cathode to anode.

$$\text{At Anode} \quad : \quad Zn_{(s)} \longrightarrow Zn^{2+}_{(aq)} - 2e^-$$

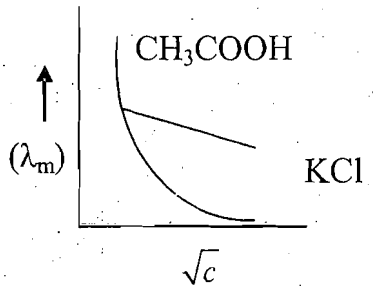
$$\text{At Cathode} \quad : \quad Cu^{2+}_{(aq)(1m)} + 2e^- \longrightarrow Cu_{(s)}$$

$$\text{Cell reaction} : \quad Zn_{(S)} + Cu^{2+} \rightleftharpoons Zn^{2+}_{(aq)(1m)} + Cu_{(s)}$$

35. The Specific conductance (K) decreases with increase in dilution because number of dissolved ions with in a area of cross section of $1m^2$ or $1cm^2$

The Molar conductivity (λ_m) increases very slowly with dilution. For stronger electrolytes

But in the case of weak electrolytes, the molar conductivity increases steeply with dilution as shown in Graph.



36. Consider a Zero order reaction

$$R \longrightarrow P$$

According to Law of mass action.

$$R = K[R]^0 \longrightarrow \quad (1)$$

Where rate of reaction $= \frac{-d[R]}{dt}$

$$\frac{-d[R]}{dt} = K$$

$$-d[R] = K \times dt$$

$$d[R] = -K \times dt \longrightarrow \quad (2)$$

on integration $\int d[R] = -K \times \int dt$

$[R] = -Kt + I$ ..... (3)

Where 'I' is integration constant.

To find I,

Consider time t =0, $[R] = [R]_0$

Substitute in equation [3]

$[R]_0 = K \times 0 + I$

$I = [R]_0$ ..... (3)

Substitute value of I in quation (3)

$[R] = Kt + [R]_0$

$Kt = [R]_0 - [R]$

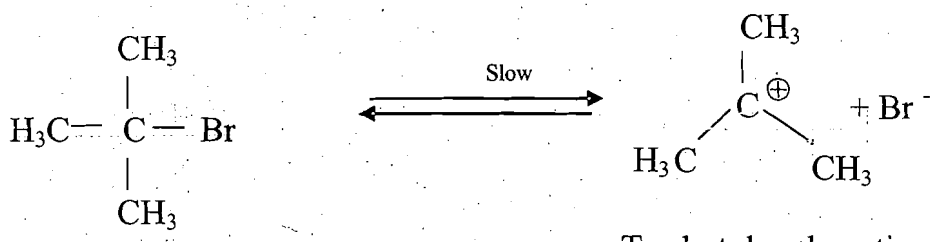
$K = \frac{[R]_0 - [R]}{t}$

37. S_N1

(a) Nucleophilic substitution First order reaction

$r = [(CH_3)_3 - Br]^1 [OH^-]^0$

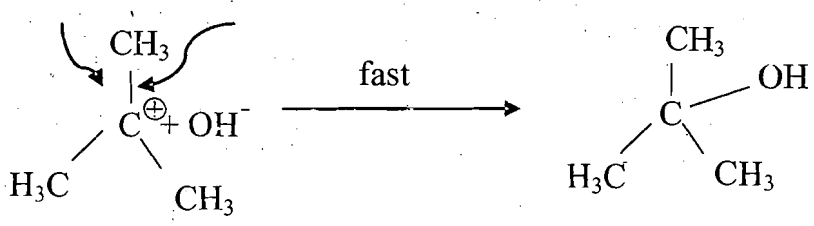
Step 1: Formation of Carbocation.



Ter-butyl bromide

Ter-butyl carbocation.

Step 2: The Nucleophile (OH^-) attacks on either side of the carbocation forms ter-butyl alcohol.



Tert-butyl alcohol

(b) reasons (each carries one mark)

i) The C-X bond acquires double bond due to resonance.

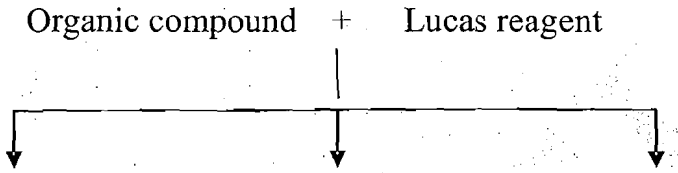
ii) The C- X bond acquires double bond character as it is SP^2 hybridised. More % of S character. Halogen atom tightly hold to the carbon atom.

iii) Instability of phenyl cation.

iv) Electron rich benzene ring repels electron rich nucleophile.

v) The Bond lengh between C- X and C= X (double bond character) distorts the stability.

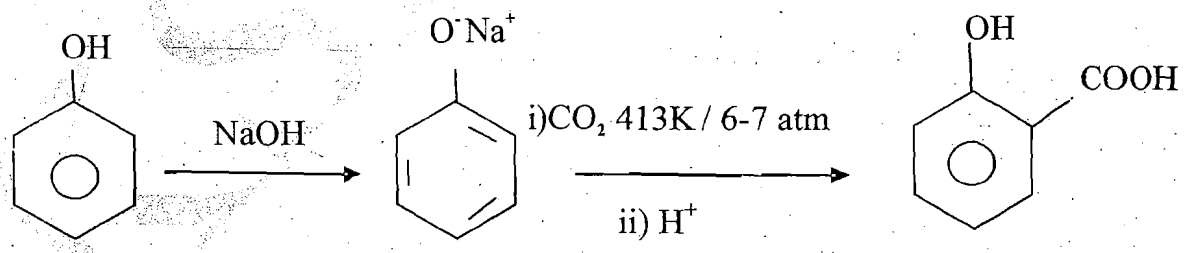
38. (a) Lucas reagent is a mixture of Anhydrous $ZnCl_2$ and Concentrated HCl



Turbidity Appears Immediately (3^0 alcohol)	Turbidity appears after 5 minutes (2^0 alcohol)	Turbidity appears only after heating (1^0 alcohol)

(b) Kolbe's Process

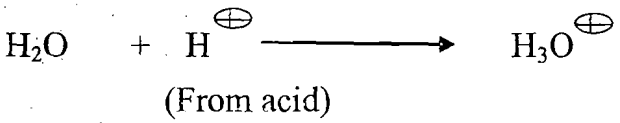
Sodium phente on heating with CO_2 gas at 413K & 6 -7 atom pressure gives sodium salicylate which on acidification gives salicylic acid.



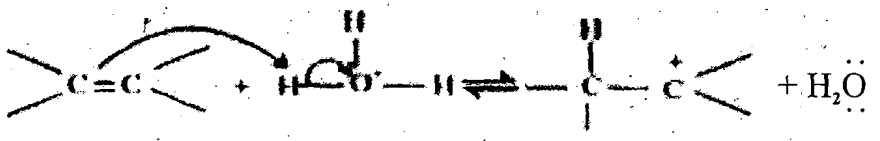
Phenol — Sodium Phenoxide — Salcyclic acid.

39. (a) Acid catalysed hydration of alkenes to alcohols.

Step 1: Protonation of alkene to form carbocation by electrophilic attack of $H_3O^{\oplus}$

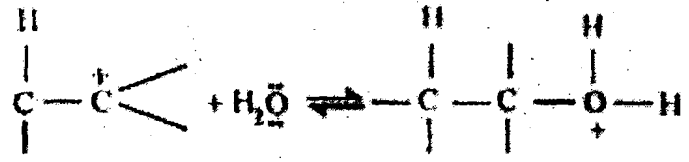


(From acid)

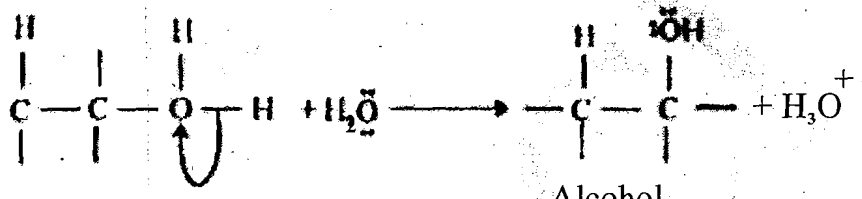


Carbocation

Step 2 :- Nucleophilic attack of water on carbocation.



Step 3: Deprotonation to form an alcohol.



Alcohol

(b) Williamson's ether synthesis

$CH_3 - O - CH_3$ OR Methoxy methane

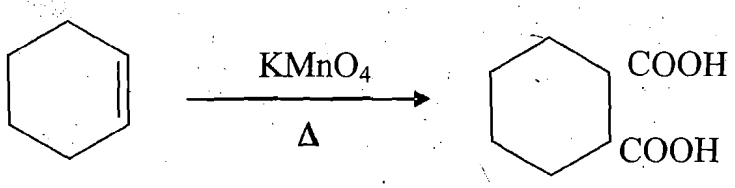
40.

(a) Butan -1 – ol to butanoic acid

$$CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow[\text{Jones reagent}]{CrO_3\ H_2SO_4} CH_3 - CH_2 - CH_2 - COOH$$

Butanoic acid.

(ii)



Cyclo hexene

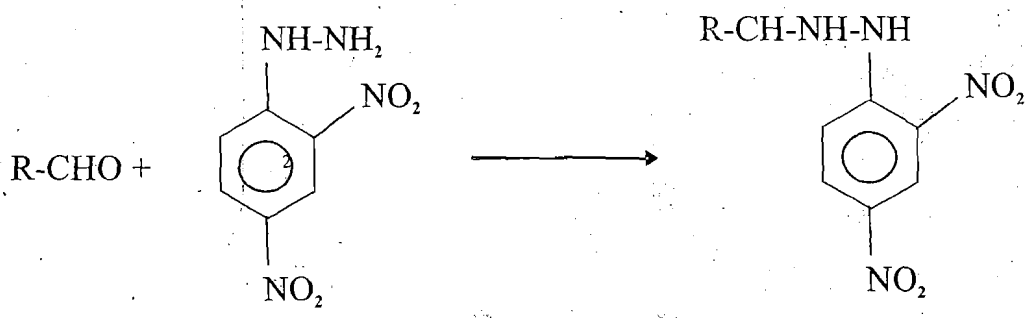
Hexan – 1, 6, dioic acid (Adipic acid)

(b) Electron withdrawing groups (NO_2, CN) increases the acidity of carboxylic acids by resonance stabilization of carboxylate ion.
Electron donating groups (CH_3, C_2H_5) decreases the acidic strength by destabilizing the carboxylate ion

41(a) The reduction of aldehydes and ketones into corresponding hydrocarbons by heating with a mixture of hydrazine and strong base like KOH in ethylene glycol solvent.

$$\underset{\text{Ethanal}}{CH_3CHO} \xrightarrow[\text{Ethylene glycol}]{NH_2\text{-}NH_2+KOH} \underset{\text{Ethane}}{CH_3\text{-}CH_2}$$

(b) Aldehyde reacts with 2,4 – dintrophenyl hydrazine (2, 4-DNPH) to form 2, 4 – dintrophenyl hydrazones.



42. (a) A- Benzoic acid (C_6H_5COOH)
B – Benzamide ($C_6H_5CONH_2$)
C – Aniline ($C_6H_5NH_2$)

(b) Reasons

(1) It is due to formation of inter molecular hydrogen bonding with water.

(2) As the number of electron donating group increases, basicity also increases.

43.

(a) Glucose on heating with HI and red phosphorous give n- hexane.

$$\underset{\text{CH}_2\text{OH}}{\overset{\text{CHO}}{(\text{CHOH})_4}} \xrightarrow{HI + \text{Red P} \longrightarrow} \underset{\text{n – hexane}}{CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3}$$

This shows that Glucose contains all the six carbon atoms in the straight chain.

(b) Polypeptide chains coil around forms spherical shape and soluble in water

Ex :- Insulin, Albumin ; Heamoglobin

(c) (A=T) 2 – Hydrogen bonds.

VII.

44. Henry's law

$P_{H_2S} = K_H \; X_{H_2S}$

We know that $X_{H_2S} = \frac{n_{H_2S}}{n_{H_2S} + n_{H_2O}} = \frac{0.195}{0.195+55.55} = 0.0035$

$$K_H = \frac{P_{H_2S}}{X_{H_2S}} = \frac{0.987 \text{ bar}}{0.0035} = 282 \text{ bar}$$

45. Data

$W_2 = 5g$

$V = 100 \text{ ml} = 0.1 \text{ L}$

$$\Pi = \frac{W_2RT}{M_2V} = \frac{5 \times 0.0821 \times 300}{60 \times 0.1} = 20.525 \text{ atm}$$

46.

$$\Delta G^0 = - nFE^0_{cell}$$

$$E^0_{cell} = E^0_{cahode} - E^0_{Anode.}$$

$$= E^0_{Ag} - E^0_{Zn}$$

$$= + 0.80 - (-0.76V)$$

$$= + 0.80 + 0.76V$$

$$= 1.56V$$

$$\Delta G^0 = - nFE^0$$

$$= -2 \times 96{,}500 \times 1.56V$$

$$= -301.080 \text{ KJmol}^{-1}$$

47.

$$E_{cell} = E^0_{cell} - \frac{0.0591}{n} \log_{10} \left| \frac{[\text{anodic conc}]^X}{[\text{cathodic conc}]^Y} \right|$$

$$= E^0_{cell} - \frac{0.0591}{n} \log_{10} \left| \frac{[Fe^{2+}]^1}{[H^+]^2} \right|$$

$$= (0 - (0.44V) - \frac{0.0591}{2} \log_{10} \frac{0.001}{1^2}$$

$$= 0.44 - 0.02955\ (-3)$$

$$= 0.52865\ V \qquad = \underline{0.53\ V}$$

48. Data

$T_1 = 27 + 273 = 300\ K$

$T_2 = 37 + 273 = 310\ K$

$K_1 = x$

$K_2 = 2x$ (doubles

$E_a = ?$

$R = 8.314\ J/K/mol$

$$\log_{10} \frac{K_2}{K_1} = \left[\frac{E_a}{2.303R}\right] \frac{T_2 - T_1}{T_1 T_2}$$

$$\log_{10} \frac{2x}{x} = \frac{Ea}{2.303 \times 8.314} \times \frac{310-300}{310 \times 300}$$

$$\log^2_{10} = \frac{Ea}{19.147} \times \frac{310-300}{310 \times 300}$$

$$E_a = 0.3021 \times 19.147 \times 9300$$

$$= 53794.071\ J/mol$$

$$= 53.73\ K\ J/mol$$

49.

$[R]_0 = 400 \text{ mol } L^{-1}$

$[R] = 25 \text{ mol } L^{-1}$

$t = 200$ seconds.

$K = ?$

For First Order Reaction

$$K = \frac{2.303}{t} \log_{10} \frac{[R]_0}{[R]}$$

$$= \frac{2.303}{200} \log_{10} \frac{400}{25}$$

$$= \frac{2.303}{200} \times 1.204$$

$$= 0.01386 \ S^{-1}$$

$$= 1.386 \times 10^{-2} \ S^{-1}$$

****

MODEL PAPER GIVEN BY KSEAB : 2023-24

Model Question Paper-10

Chemistry

Time : 3 Hrs . 15 Mins. **Max.Marks : 70**

Instructions:

1. Question paper has FIVE parts. All parts are compulsory.
2. a. Part-A carries 20 marks. Each question carries 1 mark.
   b. Part-B carries 06 marks. Each question carries 2 marks.
   c. Part-C carries 15 marks. Each question carries 3 marks.
   d. Part-D carries 20 marks. Each question carries 5 marks.
   e. Part-E carries 09 marks. Each question carries 3 marks.
3. In Part-A questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labeled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and specific unit for final answer will not carry any marks.
6. Use log tables and simple calculator if necessary (use of scientific calculator is not allowed).

Part-A

I. Select the correct option from the given choices **1x15=5**

1. Aquatic species are more comfortable in cold water rather than in warm water. This is due to
   a) Solubility of oxygen is more in warm water.
   b) Solubility of oxygen is more in cold water.
   c) Solubility of gases increases with decrease of temperature.
   d) Both (b) and (c)
2. Which of the following cell was used in Apollo space programme?
   a) Mercury cell b) Daniel cell c) H_2-O_2 Fuel cell d) Dry cell
3. During electrolysis of aqueous solution of NaCl, the reaction preferred at anode is
   a) $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$ b) $H_2O(l) + e^- \rightarrow \frac{1}{2} H_2(g) + OH^-$
   c) $Cl^-(aq) \rightarrow \frac{1}{2} Cl_2(g) + e^-$ d) $\frac{1}{2} Cl_2(g) + e^- \rightarrow Cl^-(aq)$
4. Order of a reaction is determined by
   a) Balanced chemical equation b) unbalanced chemical reaction
   c) Experimental rate expression d) thermo-chemical equation
5. Ionic character decreases in the following oxides.
   a) $Mn_2O_7 > MnO_2 > MnO$ b) $MnO > MnO_2 > Mn_2O_7$
   c) $Mn_2O_7 > MnO > MnO_2$ d) $MnO > Mn_2O_7 > MnO_2$
6. The oxidation state of Fe in $[Fe(CO)_5]$ is
   a) +2 b) 0 c) +3 d) +5
7. Name the gases liberated when primary alcohols react with thionyl chlorides are
   a) $SO_2 + H_2$ b) H_2+HCl c) SO_2+HCl d) $NO_2 + H_2$

8. Phenol molecule is less stable than phenoxide ion because
   a) Phenol resonance structures have charge separation but not in phenoxide ion.
   b) phenoxide ion resonance structure have charge separation but not in phenol.
   c) Both phenoxide ion & phenol resonance structure have charge separation.
   d) Both phenoxide ion &phenol resonance structure do not have charge separation.
9. Glycerol is an example for
   a) Dihydric alcohol b) Dihydric phenol c) Trihydric phenol d) Trihydric alcohol
10. Tollen's reagent is
   a) Silver nitrate solution b) Ammonical silver nitrate solution
   c) Ammonium nitrate solution d) Silver chloride solution
11. Carboxylic acids exists in dimeric form even in vapour phase due to
   a) Hydrogen bond b) peptide bond c) ionic bond d)metallic bond
12. The state of hybridization of orbitals of nitrogen atom in aliphatic amines is
   a) sp^2 b)sp^3 c) sp d) dsp^2
13. Benzene diazonium chloride reacts with phenol to form p-hydroxy azobenzene in
   a) acidic medium b) Neutral medium
   c) Basic Medium d) Both acidic and neutral medium.
14. Thiamine is a chemical name of
   a) Vitamin A b) Vitamin B_1 c) Vitamin C d) Vitamin K
15. The nitrogenous base adenine form hydrogen bonding with
   a) Thymine b) Cytosine c) Guanine d) None of the above

II. Fill in the blanks by choosing the appropriate word from those given in the brackets: **1x5=5**

(phosgene, tin, hydrogen, molecularity, zinc, cellulose acetate)

16. The semipermeable membrane used in the reverse osmosis is_____
17. The number of molecules taking part in the elementary reaction is called_____
18. The non-transitional metal present in brass is_____
19. The poisonous gas formed when chloroform is exposed to air and light is_____
20. Solubility of ethylamine in water is due to formation of _____ bonding with water.

Part-B

III. Answer any three of the following. Each question carries two marks: **3x2=6**

21. How does boiling point of solvent vary when a non-volatile solute is dissolved in it? Explain.
22. Define order of a reaction. If unit of rate constant of a reaction is same as the unit of rate of reaction, then what is the order of the reaction?
23. What are chelate ligands? Give an example.
24. Write the general equation for Finkelstein reaction. What is the role of dry acetone in this reaction?

25. Complete the equation and name the reaction:

$$R\text{-}\overset{\overset{O}{\|}}{C}\text{-}CH_3 \xrightarrow{NaOX}$$

26. Name the two hormones which regulate the glucose level in the blood.

Part-C

IV. Answer any three of the following. Each question carries three marks: **3x3=9**

27. Calculate the magnetic moment of M_{aq}^{3+} ion. (z=24)
28. Explain the structure of dichromate ion ($Cr_2O_7^{2-}$).
29. What is Lanthanoid contraction? Mention two of its consequences.
30. Write the IUPAC names and the type of isomerism for the following complexes
    (a) $[Co(NH_3)_5Br]SO_4$ (b) $[Co(NH_3)_5SO_4]Br$.
31. Using Valence Bond Theory [VBT], explain geometry, hybridisation and magnetic property of $[CoF_6]^{-3}$ ion. [Atomic number of Cobalt is 27].
32. Draw the energy level diagram for the crystal field splitting in tetrahedral complexes. Write the relation between Δ_0 and Δ_t for the complexes having same metal, the same ligand and metal – ligand distances.

V. Answer any two of the following. Each question carries three marks: **2x3=6**

33. Write any three differences between ideal and non-ideal solutions.
34. State Kohlrausch's law of independent migration of ions. Mention its applications.
35. Explain the experimental determination of conductance of electrolytic solution by using Wheatstone bridge.
36. Derive integrated rate equation for first order gas phase reaction.

Part-D

VI. Answer any four of the following. Each question carries five marks: **4x5=20**

37. a. Write the mechanism involved in the following reaction.

$$(CH_3)_3CBr + O^-H \longrightarrow (CH_3)_3COH + Br^-$$

Identify the reactant on which rate of reaction depends.

b. Define stereo center? How many asymmetric carbon atoms are there in 2,3-dichlorobutane? **(3+2)**

38. a. Identify A, B and C in the following reaction:

$$A + H_2 \xrightarrow{Pd} C_2H_5OH \begin{cases} \xrightarrow[443k]{H_2SO_4} B \\ \xrightarrow[413k]{H_2SO_4} C \end{cases}$$

b. Describe the manufacture of methanol from water gas. **(3+2)**

39. a. An aromatic hydrocarbon 'A' having molecular formula C_9H_{12} is oxidised in the presence of air gives compound 'B'. The compound 'B' is treated with dilute acid gives two organic compounds 'C' and 'D'. The compound 'C' forms white precipitate 'E' with bromine water. Write the chemical reactions with names of A, B, C and E.

b. Give an example for unsymmetrical (mixed) ether. **(4+1)**

40. a) Write the chemical equation for the reaction when benzaldehyde is slightly heated with acetophenone in the presence of dilute alkali. Give the IUPAC names the products obtained in this reaction.

b) Explain Rosenmund reduction with an example.

c) Alpha (α)-Hydrogens of aldehydes and ketones are acidic. Give reason.. **(2+2+1)**

41. a) A Grigand reagent 'X' reacts with CO_2 (dry ice) followed by acid hydrolysis gives ethanoic acid. Write the chemical equations. What is the name of the compound 'X'?

b) Between methanoic acid and ethanoic acid, which is more acidic? Give reason.. **(3+2)**

42.a. Write the chemical name & the structure of Hinsberg's reagent. 3^0 amines do not react Hinsberg's reagent. give reason.

b. Explain Carbylamine reaction with an example. **(3+2)**

43.a. (i) The penta-acetate of glucose does not react with hydroxylamine. What does it indicate?

(ii) Write chemical reaction to show the open chain structure of D-Glucose which contains six carbon atoms in the straight chain.

b. What is Zwitter ion of an amino acid? Give its general formula.

c. Which hormone is responsible for the hypothyroidism? **(2+2+1)**

PART-E (PROBLEMS)

VII. Answer any three of the following. Each question carries three marks: **3x3=9**

44. 100g of liquid 'A' (molar mass 140 $gmol^{-1}$) was dissolved in 1000g of liquid 'B' (molar mass 180 $gmol^{-1}$). The vapour pressure of pure liquid 'B' was found to be 500 torr. Calculate the vapour pressure of pure liquid 'A' if the total vapour pressure of the solution is 475 torr.

45. The boiling point of benzene is 353.23K. When 1.8g of non-volatile solute was dissolved in 90g of benzene, the boiling point is raised to 354.11K. Caculate the molar mass of the solute. (Given K_b for the benzene is 2.53K$kgmol^{-1}$).

46. At 298K, the EMF of the cell: $Mg(s)|Mg^{2+}(Q)||Ag^{+}(0.01)|Ag(s)$ is 3.022V. Calculate the value 'Q'. (Given : $E^0_{Mg^{2+}/Mg} = -2.37V$ and $E^0_{Ag^{+}/Ag} = 0.80V$)

47. The resistance of 0.01M acetic acid solution is found to be 2220Ω, when measured in a cell has two electrodes of area 3.85cm^2 placed 10.5cm apart. Calculate the conductivity.

48. For the first order reaction, half-life period of the reaction is 120 minute. Calculate the time taken to complete 90% of the reaction.

49. The rate constants of a reaction are $2 \times 10^{-2}s^{-1}$ at 300K and $8 \times 10^{-2}s^{-1}$ at 320K. Calculate the energy of activation of the reaction. (Given: R=8.314 $JK^{-1}mol^{-1}$).

Answers

I.

1. d) both (b) and (c).
2. c) H_2-O_2 fuel cell
3. c) $Cl^-(aq) \rightarrow \frac{1}{2} Cl_2(g) + e^-$
4. c) Experimental rate expression
5. b) $MnO > MnO_2 > Mn_2O_7$
6. b) 0
7. c) $SO_2 + HCl$
8. a) Phenol resonance structures have charge separation but not in phenoxide ion
9. d) Trihydric alcohol
10. b) Ammonium nitrate solution
11. a) Hydrogen Bond
12. b) sp^3
13. c) Basic medium
14. b) Vitamin B_1
15. a) Thymine

II.

16. Cellulose acetate
17. Molecularity
18. Tin
19. Phosgene
20. Hydrogen

III.

21. When a non-volatile solute is dissolved in solvent, the boiling point of solvent increases. The boiling point of a solution is always higher than that of the boiling point of the pure solvent. Because vapour pressure of the solvent decrease in the presence of non- volatile solute, hence it requires raising the temperature of the solution.
22. The sum of powers of the concentration of the reactants in the rate law expression is called the order of chemical reaction.

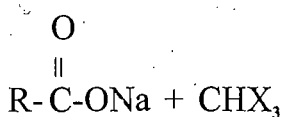
    For Zero order reaction, Unit of rate constant of a reaction is same as the unit of rate of reaction.
23. When di or polydentate Ligands uses its two or more- donor atom to bind a single metal ion are called chelate ligands.

    Example: Ethylene diamine, Oxalate ion, Glycinate ion, etc.....
24. Iodoalkanes are prepared by the reaction of alkyl chloride or alkyl bromide with sodium iodide in dry acetone.

$$\underset{\substack{\text{Alkyl chloride}\\ \text{or bromide}\\ (X=Cl, Br)}}{R-X} + NaI \xrightarrow{\text{Dry acetone}} \underset{\text{Iodo alkane}}{R-I} + NaX$$

The presence of dry acetone, NaCl or NaBr formed is precipitated and facilitates the forward reaction according to Le Chatelier's principle.

25.



Name of this reaction is Haloform reaction OR chloroform reaction.

26. The two hormones which regulate the glucose level in the blood are Insulin & Glucagon.

IV.

27. $M=24=[Ar]^{18}\ 4s^1 3d^5 \rightarrow M^{3+} = 21 = [Ar]^{18}\ 4s^0\ 3d^3$

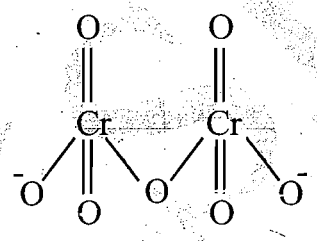
Hence it has 3 unpaired electrons i.e., n=3

$$\mu = \sqrt{n(n+2)}B.M.$$
$$= \sqrt{3(3+2)} = \sqrt{15}$$

Magnetic moment, μ $= 3.87\ BM$

28. Potassium dichromate has two chromium atoms. Each chromium undergoes sp^3 hybridisation having two tetrahedral structures joined through the oxygen atom, i.e., one oxygen is bonded to both the chromium atoms. Hence potassium dichromate contains one bridge oxygen atom and six terminal oxygen atoms.

Cr-O-Cr Bond, angle is 126^0.



29. The overall decrease in atomic radii and ionic radii from lanthanum to lutetium (across lanthanoids) is called Lanthanoid contraction.

Consequences:

1. The separation of lanthanoids in pure state becomes difficult.
2. The radii of 3rd row transition series elements are almost similar to that of 2nd row transition series elements. OR the identical radii of Zirconium (Zr) and Hofnium (Hf)
3. Basicity of lanthanoids decreases.
4. Covalent character increases.

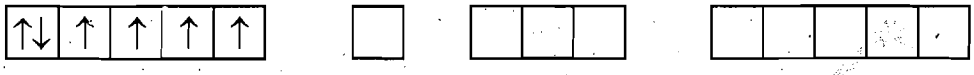
30. IUPAC names of $[Co(NH_3)_5Br]SO_4$ complex is pentaammminebromidocobalt(III) sulphate.

IUPAC names of $[Co(NH_3)_5SO_4]Br$ complex is pentaamminesulphatocobalt (III) bromide.

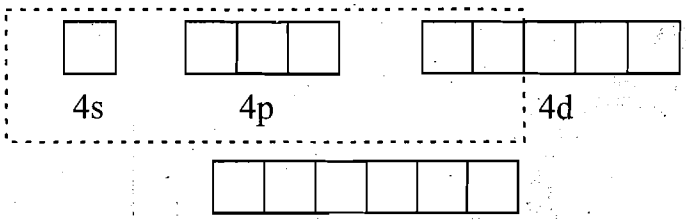
These two complex isomers exhibit ionization isomerism.

31. In this complex, the oxidation state of Cobalt is +3. F-ion provides a weak ligand field.

The electronic configuration of Cobalt in +3 oxidation state is [Ar] $3d^6 4s^0$.



One 4s, three 4p & two outer 4d-orbitals hybridised to yield six $sp^3 d^2$ hybrid orbitals pointing towards the six corners of an ochahedron.



These hybridised orbitals of Co^{3+} ion overlap with orbitals of F^- ligands and forms six coordinate bonds between Co^{+3} & F^- ligand.

Six $sp^3 d^2$ hybrid orbitals with six pairs of electrons from F- ligand:

Thus, the complex has octahedral geometry.

This complex is paramagnetic due to presence of unpaired electrons.

Hybridisation: $sp^3 d^2$; Geometry : Octahedral;

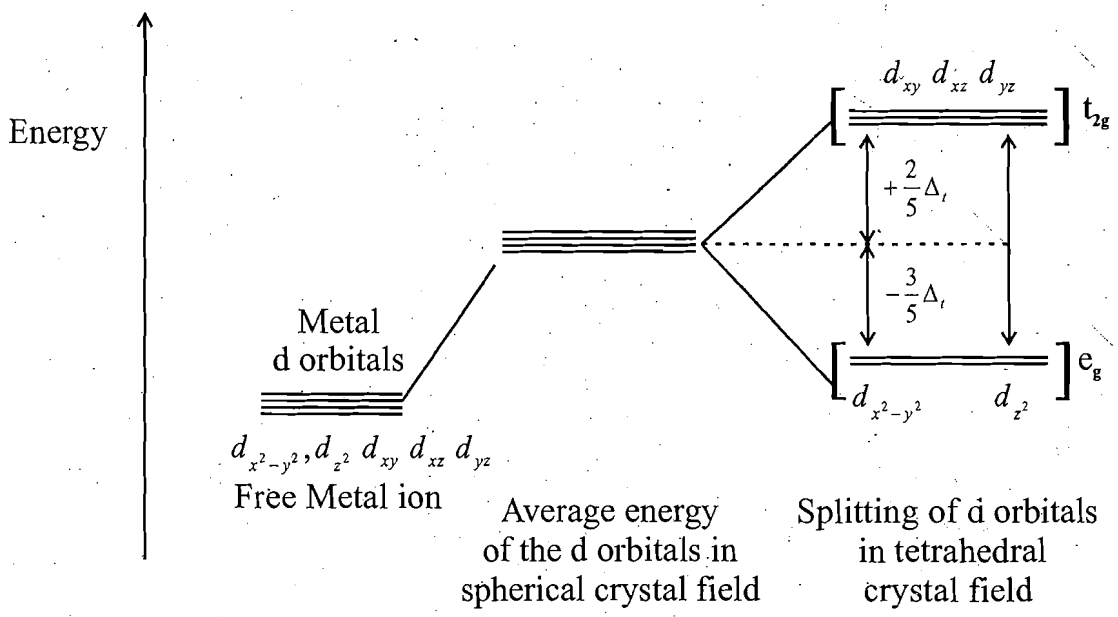
Magnetic property: paramagnetic due to presence of unpaired electrons.

32. In tetrahedral coordination entity formation, the 'd' orbital splitting is inverted and smaller compared to the octahedral field splitting.

In presence of ligands, the d-orbitals splits into two sets, namely higher energy t_{2g} orbitals containing d_{xy} , d_{yz} , d_{xz} orbitals and lower energy 'e_g' orbitals containing $d_{x^2-y^2}$ and d_{z^2}.

For 'e_g' orbitals the decrease in energy is $-\frac{3}{5}\Delta_t$ and

For t_{2g} orbitals, the increase in energy is $+\frac{2}{5}\Delta_t$



The relation between Δ_0 and Δ_t is $\Delta_t = (4/9)\,\Delta_0$

V

33.

IDEAL SOLUTIONS	NON-IDEAL SOLUTIONS
Obeys Raoult's law. $P_1 = x_1P_1^0$, $P_2 = x_2P_2^0$	Does not Obeys Raoult's law. $P_1 \neq x_1P_1^0$, $P_2 \neq x_2P_2^0$
Enthalpy of mixing of the pure components to form the solution, $\Delta_{mix}H=0$.	Enthalpy of mixing of the pure components to form the solution, $\Delta_{mix}H\neq0$.
Volume of mixing $\Delta_{mix}V=0$.	Volume of mixing $\Delta_{mix}V\neq0$.
An ideal solution will be formed when intermolecular forces of attraction between the molecules of solute (A-A) and those between the molecules of solvent (B-B) are nearly equal to those between solute and solvent molecules (A-B).	An ideal solution will be formed when intermolecular forces of attraction between the molecules of solute (A-A) and those between the molecules of solvent (B-B) are not equal to those between solute and solvent molecules (A-B).

34. "At infinite dilution when the dissociation of the ions is complete each ion makes a definite contribution to the total molar conductance irrespective of the nature of the other ion".Applications:-

i. In the Calculation of molar conductivity at infinite dilution (Λ_0) for weak electrolytes.

ii. In the Calculation of Degree of Dissociation (α).

iii. In the Calculation of Dissociation Constant (K). (Any Two)

35. The accurate measurement of an unknown resistance can be performed using the principle of a Wheatstone bridge. It consists of four arms. The determination involves

the two steps.

Step 1: Determination of cell constant (G^*) of conductivity cell

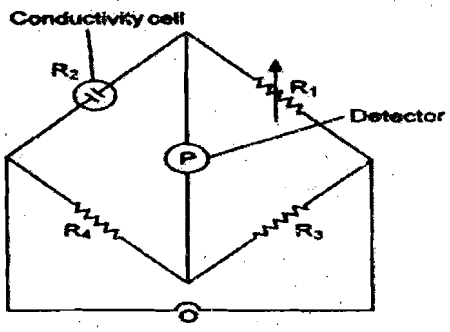
Cell constant is usually determined by measuring resistance of Conductivity cell containing KCI solution of known specific conductance (k).

The cell constant(G^*) of the conductivity cell is calculated using the relation.

$$G^* = Rk$$

Step 2: Measurements of Specific Conductivity (k) of the given electrolyte solution

The conductivity cell is now filled with given electrolytic solution is connected to the Wheatstone bridge as shown in the figure. Two resistance R_3 and R_4 are fixed resistances. R_1 is a variable resistance and R_2 be the resistance of conductivity cell having unknown resistance. The bridge is connected to source of A.C. power and P is the suitable detector.



The bridge is balanced in such a way that no current in the detector. The resistance of the conductivity cell is given by,

$$\therefore R_2 = \frac{R_1 R_4}{R_3}$$

The resistance R_2 of the electrolytic solution is determined. Specific conductance of the electrolytic solution is calculated using the relation,

$$k = \frac{G^*}{R_2}$$

36. Consider a first order gas phase reaction: $A_{(g)} \rightarrow B_{(g)} + C_{(g)}$

P_i = Initial pressure of reactant 'A' and p_t = total pressure at time 't',

Then total pressure, $p_t = p_A + p_B + p_C$

p_A, p_B and p_C are the partial pressures of gaseous reactant and products A, B and C respectively.

If x atm is decrease in pressure of A at time t and one mole each of B and C is being formed, then the increase in pressure of B and C will also be x atm each.

	$A_{(g)}$	$\rightarrow$	$B_{(g)}$	$+ C_{(g)}$
At t=0	p_i atm		0 atm	0 atm
At time t	$(p_i - x)$ atm		x atm	x atm

Where, p_i is the initial pressure at t=0

$$p_t = (p_i - x) + x + x$$

$$p_t = p_i + x$$

$$x = p_t - p_i$$

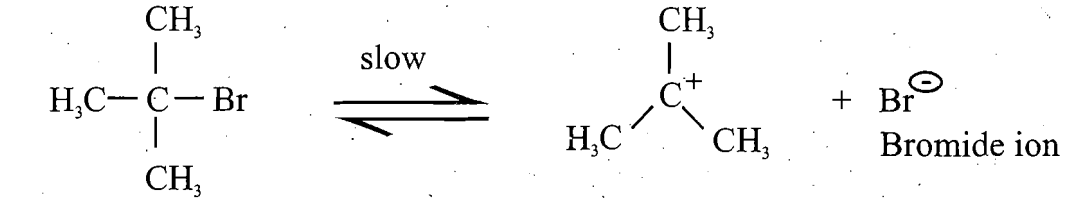
Where, $p_A = p_i - x = p_i - (p_t - p_i) = 2p_i - p_t$

$$\therefore k = \frac{2.303}{t} \log \frac{p_i}{p_A}$$

$$k = \frac{2.303}{t} \log \frac{p_i}{(2p_i - p_t)}$$

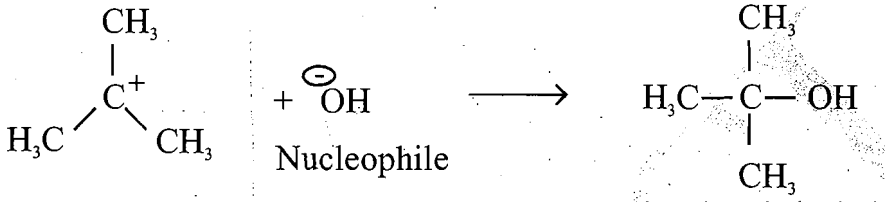
37. a.

I Step : Formation of carbocation:



tertiary butyl bromide — tertiary butyl carbocation

II Step : Attack of nucleophile:



tertiary butyl alcohol

Rate of reaction depends on concentration of the reactant haloalkane.

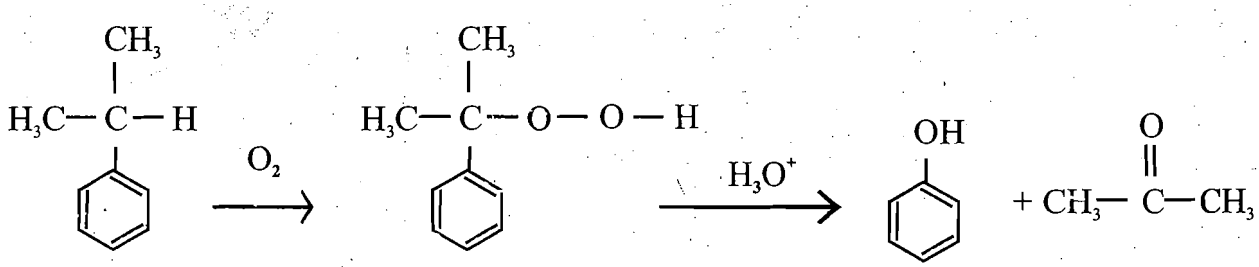
37. b) A carbon atom bonded to four different atoms or groups is called stereo centre Two or 2

38. a) A = CH_3CHO B = $CH_2=CH_2$ C = $C_2H_5OC_2H_5$

b. Methanol is produced by catalytic hydrogenation of carbon monoxide at high pressure and temperature in the presence of $ZnO-Cr_2O_3$ catalyst.

$$CO + 2H_2 \xrightarrow[200\text{-}300\ atm,\ 573\text{-}673K]{ZnO-Cr_2O_3} CH_3OH$$

39.a. When cumene (isopropyl benzene) is oxide in the presence of air, it gives cumene hydroperoxide which on acidification with dilute acid gives phenol.



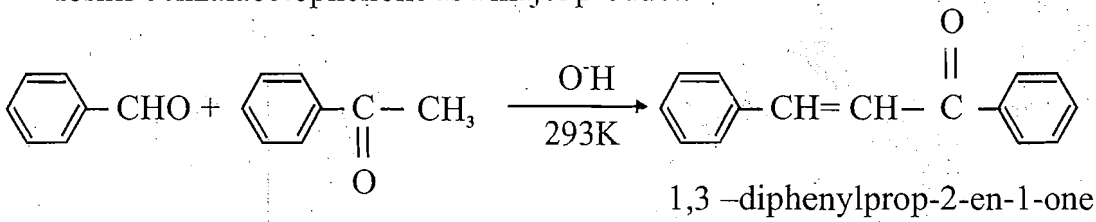
Cumene — Cumene hydroperoxide — Phenol — Acetone

2,4,6- Tribomphenol

A=Cumene B=Cumene hydroperoxide
C=Phenol D-Acetone E= 2,4,6- Tribomphenol

b. 1-Methaxypropane, Ethoxy benzene, Methoxy benzene, 1-Phenoxy heptane (any one).

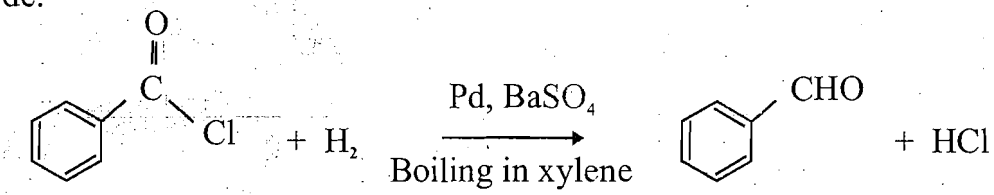
40. a) When benzaldehyde reacts with acetphenone in the presence of dilute alkali as catalyst forms benzalacetophenone as a major product.



1,3 –diphenylprop-2-en-1-one
(Benzalacetophenone)
(Major Product)

The name of the product is 1,3 –diphenylprop-2-en-1-one.
This type of reaction is known as cross aldol condensation:

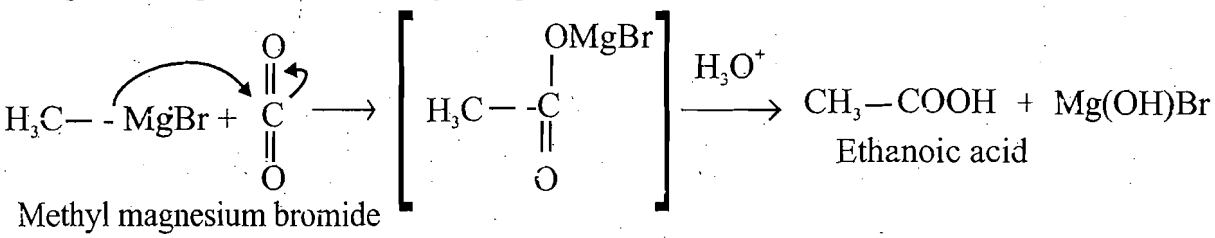
b. Acid chlorides is hydrogenated over Catalyst, palladium on barium sulphate to give aldehyde.



Benzoyl chloride Benzaldehyde

c. Because of the strong electron withdrawing effect of the carbonyl group and resonance stabilization of the conjugate base.

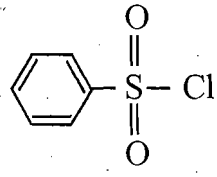
41.a. Grignard reagents ' X' is Methyl Magnesium bromide



Methyl magnesium bromide Ethanoic acid

b. Methanoic acid is more acidic.
Due to absence positive inductive effect in methanoic acid & Electron donating $-CH_3$ group decrease the acidity in ethanoic acid.

42. a.

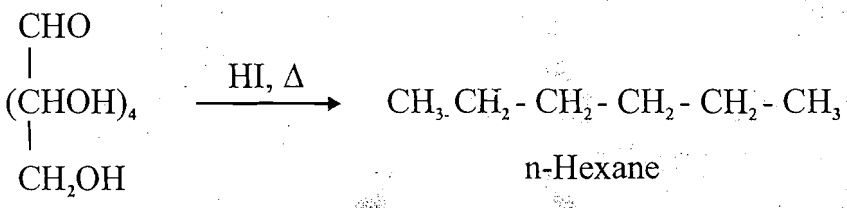
Benzenesulphonyl chloride $C_6H_5SO_2Cl$) is known as Hinsberg 's reagent. Hinsberge's reagent does not react with tertiary amine because tertiary amine does not contain any hydrogen atom attached to nitrogen atom.	

b. Primary amines on hating with chloroform and ethanolic KOH (potassium Hydroxide) gives isocyanides or carbylamines. This reaction is called carbylamine reaction.

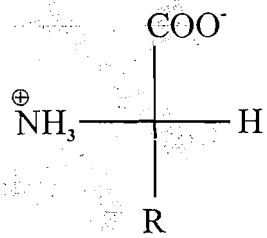
$$\underset{1^0\text{- amine}}{R\text{-}NH_2} + \underset{\text{Chloroform}}{CHCl_3} + \underset{\text{Alcoholic}}{3KOH} \xrightarrow{\Delta} \underset{\text{isocyanide}}{R\text{-}NC} + 3KCl + 3H_2O$$

43. a. (i) The absence of free aldehyde (-CHO) group.

(ii) Glucose is heated with hydrogen iodide (HI), it forms n-hexane.



b. In aqueous amino acid solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as Zwitter ion.



c. Thyroxine is hormone responsible for the hypothyroidism.

VII.

44. $w_B = 100\ g$ $\quad M_A = 140\ g\ mol^{-1}$

$w_A = 1000\ g$ $\quad M_A = 180\ g\ mol^{-1}$

$P_B^0 = 500$ torr $\quad P_{TOTAL} = 475$ torr

$$Number\ of\ Moles\ of\ liquid\ 'A' = \frac{Mass\ of\ liquid\ 'A'}{Molecular\ Mass\ of\ liquid\ 'A'} = \frac{100}{140} = 0.714$$

$$Number\ of\ Moles\ of\ liquid\ 'B' = \frac{Mass\ of\ liquid\ 'B'}{Molecular\ Mass\ of\ liquid\ 'B'} = \frac{1000}{180} = 5.56$$

$$Mole\ fraction\ of\ liquid\ 'B' = \frac{Number\ Mole\ of\ liquid\ 'B'}{Total\ number\ of\ \text{moles in solution}} = \frac{5.56}{0.714 + 5.56} = 0.89$$

Mole fraction of liquid 'A' = X_A = 1-0.89 = 0.11

$$P_{total} = P_B^0 + (P_A^0 - P_B^0)X_A$$
$$475 = 500(P_A^0 - 500)0.11$$
$$P_A^0 = \frac{475 - 500 - 55}{0.11}$$
$$P_A^0 = 272.7\ torr$$

45. Elevation of Boiling point = $\Delta T_b = T_b - T_b^0 = 354.11K - 353.23\,K = 0.88K$

$$M_2 = \frac{1000 \times w_2 \times k_b}{\Delta T_b \times w_1}$$
$$= \frac{2.53 \times 1.8 \times 1000}{0.88 \times 90} = 57.5 gmol^{-1}$$

46. Given that: $E^0_{Ag/Ag^+} = 0.80V$, $E^0_{Mg^{2+}/Mg} = -2.37V$

$[Ag^+] = 0.01M = 10^{-2}$;

$[Mg^{2+}] = ?$

$$E_{cell} = E^0_{Ag+/Ag} - E^0_{Mg^{2+}/Mg} = 0.80V - (-2.37V) = 3.17V$$

$$E_{cell} = E^0_{cell} - \frac{RT}{nF}\ln\frac{[Mg^{2+}]}{[Ag^+]^2}$$
$$E_{cell} = E^0_{cell} - \frac{0.059}{2}\log\frac{[Mg^{2+}]}{[Ag^+]^2}$$
$$3.022V = 3.17V - \frac{0.059}{2}\log\frac{Q}{10^{-4}}$$
$$\frac{(3.022 - 3.17) \times 2}{0.059} = \log Q - \log 10^{-4} = 5 = \log Q + 4$$
$$\log Q = 5 - 4 = 1$$
$$Q = anti\log(1) = 10$$

47. $\rho = \frac{RA}{I} = \frac{2220 \times 3.85}{10.5} = 814\Omega cm$

$$Conductivity(K) = \frac{1}{\text{Re}sistivity} = \frac{1}{814} = 1.29 \times 10^{-3} Scm^{-1}$$

48. Calculation of rate constant;

$$k = \frac{0.6933}{t_{1/2}} = \frac{0.693}{120}$$

$$K = 5.775 \times 10^{-3}\ \text{min}^{-1}$$

Calculation of time : $[R_0]=100$ & $[R] = 100-90=10$

$$t = \frac{2.303}{k}\log\frac{[R]_0}{[R]}$$

$$t = \frac{2.303}{5.775 \times 10^{-3}}\log\frac{100}{10}$$

$$t = 398.78\,\text{min}$$

49. Given $T_1 = 300\,K$ & $K_1 = 2 \times 10^{-2} s^{-1} = 0.02 s^{-1}$;

$T_2 = 320\,K$ & $K_2 = 7 \times 10^{-2} s^{-1} = 0.07 s^{-1}$;

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log\frac{8 \times 10^{-2} s^{-1}}{2 \times 10^{-2} s^{-1}} = \log 4 = 0.6020 = \frac{E_a}{2.303 \times 8.314}\,\frac{20}{(320 \times 300)}$$

$$E_a = \frac{0.6020 \times 2.303 \times 8.314 \times 320 \times 300}{20}$$

$$E_a = 55327\,Jmol^{-1} = 55.327\,KJmol^{-1}$$

****

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10											4	9	13	17	21	26	30	34	38
	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	16	20	24	28	32	37
11											4	8	12	15	19	23	27	31	35
	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	7	11	15	19	22	26	30	33
12											3	7	11	14	18	21	25	28	32
	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	20	24	27	31
13											3	7	10	13	16	20	23	26	30
	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	7	10	12	16	19	22	25	29
14											3	6	9	12	15	18	21	24	28
	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	17	20	23	26
15											3	6	9	11	14	17	20	23	26
	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	5	8	11	14	16	19	22	25
16											3	5	8	11	14	16	19	22	24
	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	10	13	15	18	21	23
17											3	5	8	10	13	15	18	20	23
	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	19	22
18											2	5	7	9	12	14	16	19	21
	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	11	14	16	18	21
19											2	4	7	9	11	13	16	18	20
	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	6	8	11	13	15	17	19
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
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.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
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.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
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.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
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.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
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.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
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.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
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.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
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.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
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.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20

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